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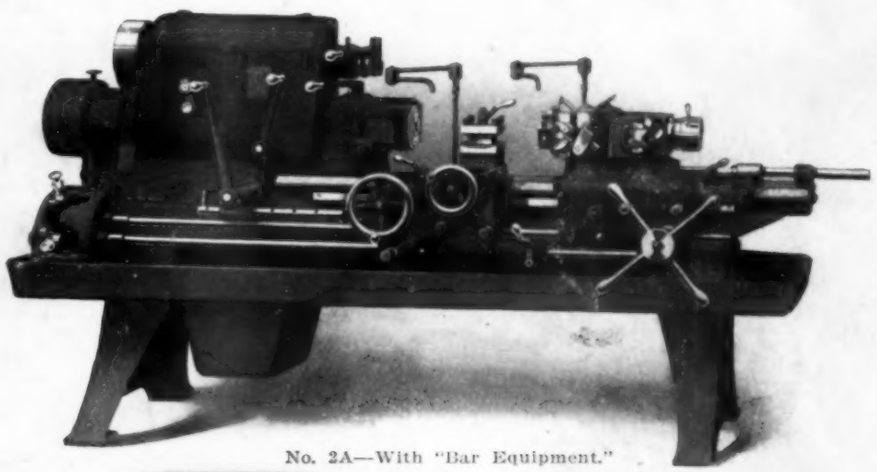

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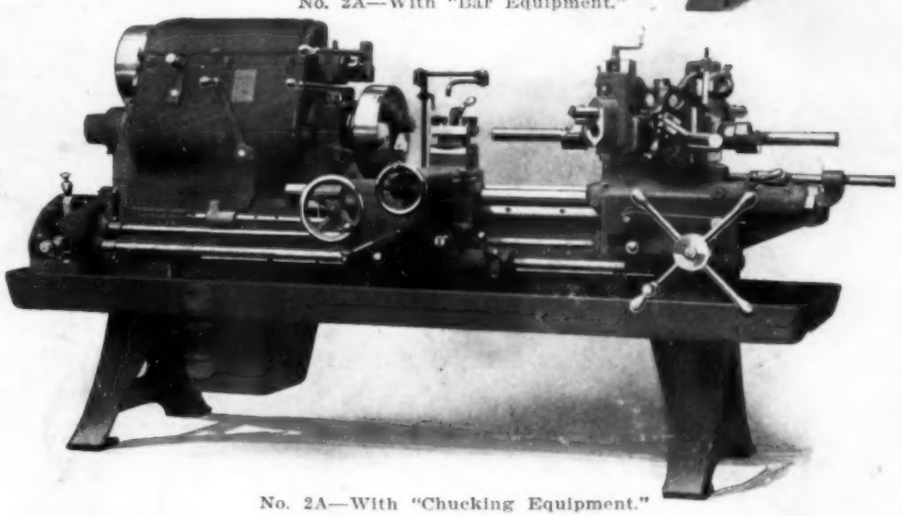

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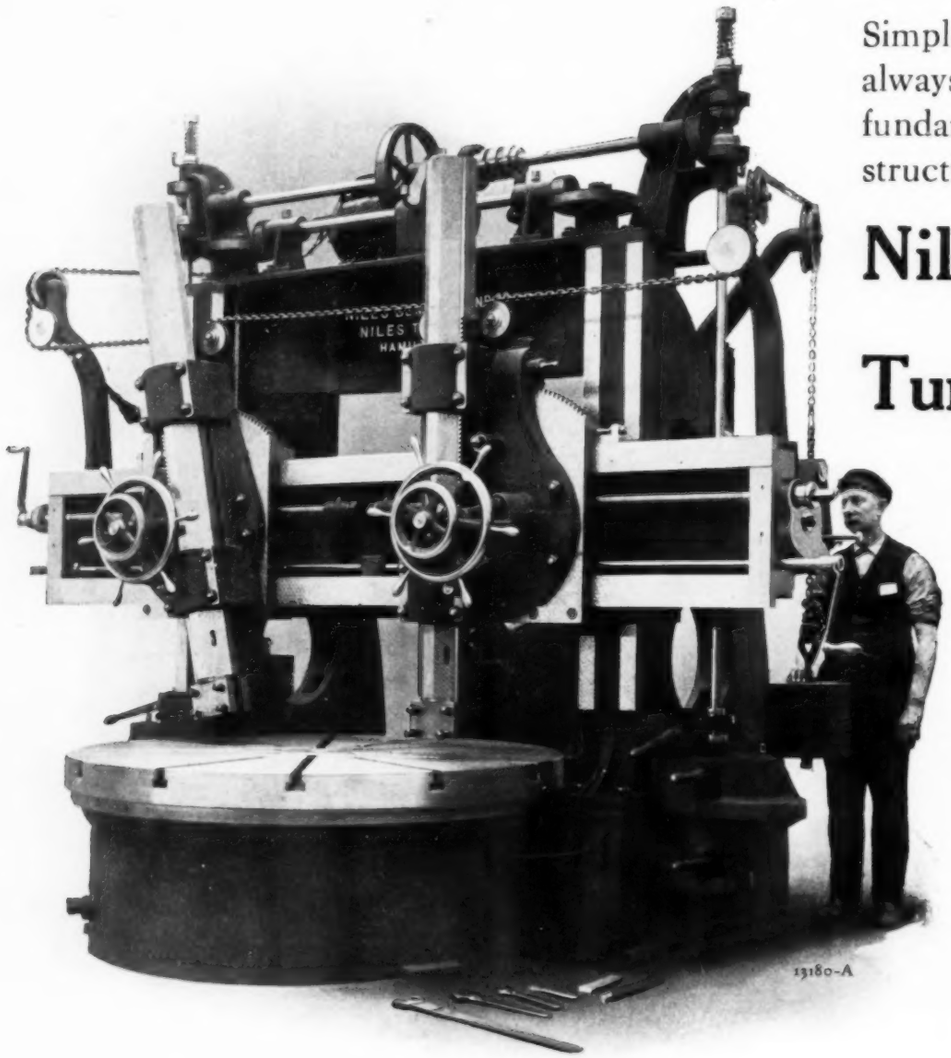

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All bearings are bronze-bushed.
On belt-driven machines sixteen speeds are instantly available through steel gearing in a speed box.
All sizes can be readily converted to motor drive at any time.
Write for catalog "Niles Boring Mills." Read also pages 62 and 63 of this issue.

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Making Panama Gate and Valve Parts

By Ethan Viall

Methods used to machine and gage some of the principal castings of the machines for operating the cylindrical valves of the canal locks.

Planing large steel castings in gangs. Turning pintle pins and water-tight manhole covers.

Many of the parts used on the gates for the Panama Canal are manufactured by the Wheeling Mold & Foundry Co., Wheeling, W. Va., the machines for operating the cylindrical valves being made entirely in this shop.

The operation of these valves will not be gone into here, but the method of machining the bonnets, bed and bearing caps will be described.

One of the valve-operating machines is shown in Fig. 1, the operating motor being shown at *A*, the bonnet at *B*, the bed and bearing cap at *C*, and the screw that works the valve gate at *D*.

In machining the bonnets, the bottom is first finished on a boring mill, a vertical flange being cut to fit the top of the cap. After the bottoms are finished, an accurately centered plate *A*, Fig. 2, grooved to receive the vertical flange, is used on the boring-mill table to locate the bonnet, and the top part is turned.

The locating plate is made so that the hardened and ground post *B* can be placed in the center hole and used to gage from. The surface *C* is gaged by slipping the bushing *D* on the post and laying a straightedge across. The surface of *E* is gaged in the same way by using the bushing *F*. The gage *G* is used to test a surface turned between *C* and *E* and lower than either, the position of which prevents the use of a straightedge.

This last gage consists of a cast-iron arm, which fits the end of the bar *B* and can swing in a circle around it. The gaging of the surface under inspection is done with the pin *H*, fitting a hole in the outer end of the arm. Great care is exercised in having all finished surfaces very accurate on this as well as all other parts, as the government inspection is very rigid.

Drilling and Gaging Bases

The base on which the motor is mounted, and the part on which the bonnet fits, are cast in one piece as shown in Fig. 3, and after being machined, the holes are drilled in the top of the base and the flanges of the bonnet seat, using the jig shown in place in Fig. 4. This jig is located by means of a vertical flange which centers it on the bonnet seat. After being seated the jig is equalized over the bed, clamped in place with heavy C-clamps and the holes drilled with a radial drilling machine.

Previous to drilling, however, the machined surfaces are tested with various gages to make sure that they are correct. The bore for the vertical flange of the bonnet is gaged as shown at *A*, Fig. 5, and the flat surface of the bearing *B* is gaged for the correct height above the pad *C*, by the height gage *D* and straightedge of the gage *E*, as shown.

The position of the shaft bearing *B* with relation to the center of the bonnet seat is determined as shown in Fig. 6. A spider gage *C* is set into the bonnet seat and the gage *D* is used to show the correctness of the ends and the cap seat of the bearing. The length and correct distance apart of the bearings *B* and *E* are gaged as shown at *F*, Fig. 7.

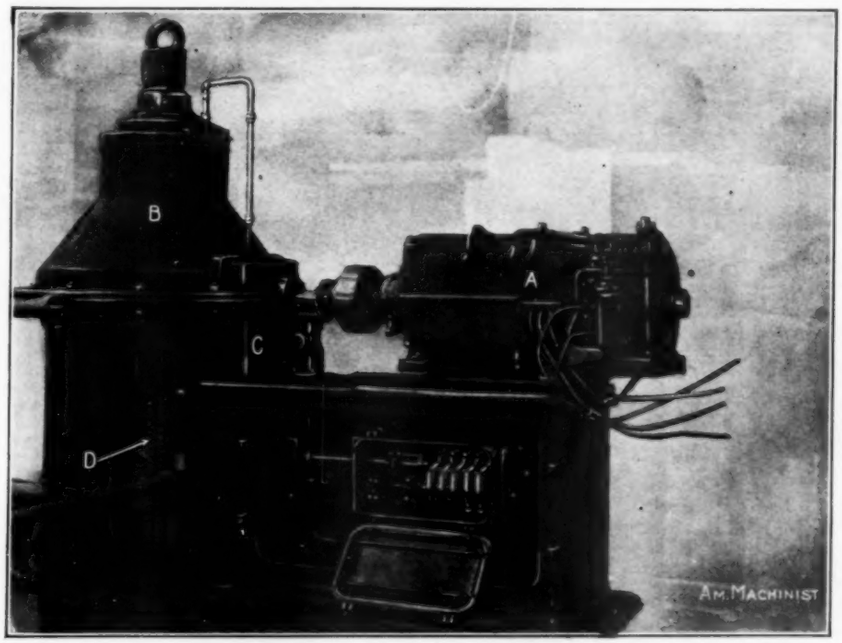


Fig. 1. Machine for Operating Cylindrical Valves

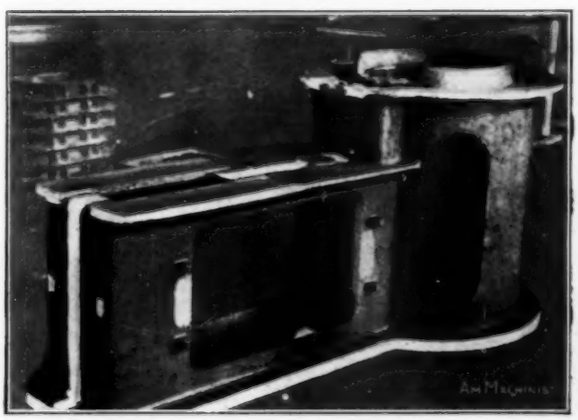


Fig. 3. Base for Motor and Bonnet

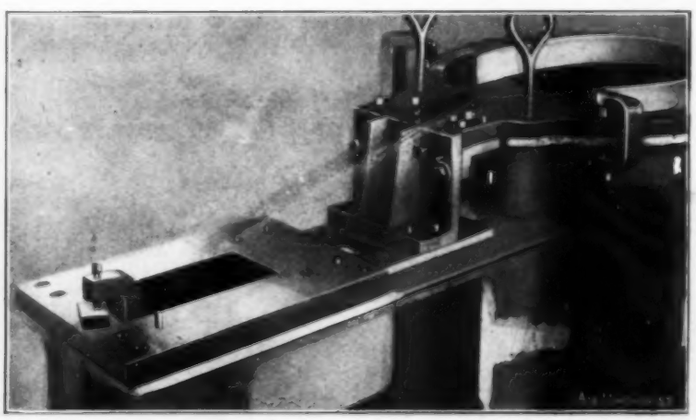


Fig. 4. Drilling Jig for the Base

Boring the Bearings

The bearings for the drive shaft are bored out with the device shown in Fig. 8. This device is bolted to the flange of the casting and is driven from the spindle of a horizontal boring mill by which it can be fed along as desired. Both bearings are bored out at the same time, vertical adjustment being obtained by means of the handle *A*. A rear view of the boring device showing the way it is mounted, is shown in Fig. 9.

Large steel castings known as reaction castings, used for ends of lock gates, are planed in gangs. The castings are first clamped four at a time onto long steel forms as shown in Fig. 10, then they are carried to the planer by the crane, and the small groove *A* is planed.

This groove is then used to line the castings up on another form, which is handled by the crane in the same way as the first, a gang being shown just ready to set down on the planer table in Fig. 11.

Two gangs are set on the planer table at once, the special tools working on them as shown in Fig. 12. Templates *A* and *B*, set at the ends, are used to plane by, hardened blocks or strips like *C* and *D* being laid on the formed edges of the templates to gage the cuts and prevent the tools from coming in contact with the templates themselves.

Drilling

The holes drilled in these castings for the purpose of fastening to the gate leaf, are drilled while the machined castings are held in the fixture shown in Fig. 13. The casting shown in the fixture weighs 1500 lb., and is carried in a sort of cradle with trunnions at each end, which revolve in heavy bearing brackets. The work is revolved to set it into the various drilling positions by means of the gear *A* bolted to the end of the cradle, which is operated through back gears, by turning the handle *B*. The cradle is locked in the drilling positions by means of the pin *C*, which fits the holes *D* in the gear rim, and a similar set of holes and a pin in the opposite end.

All the holes are drilled from the inside as shown in Fig. 14, as this is the

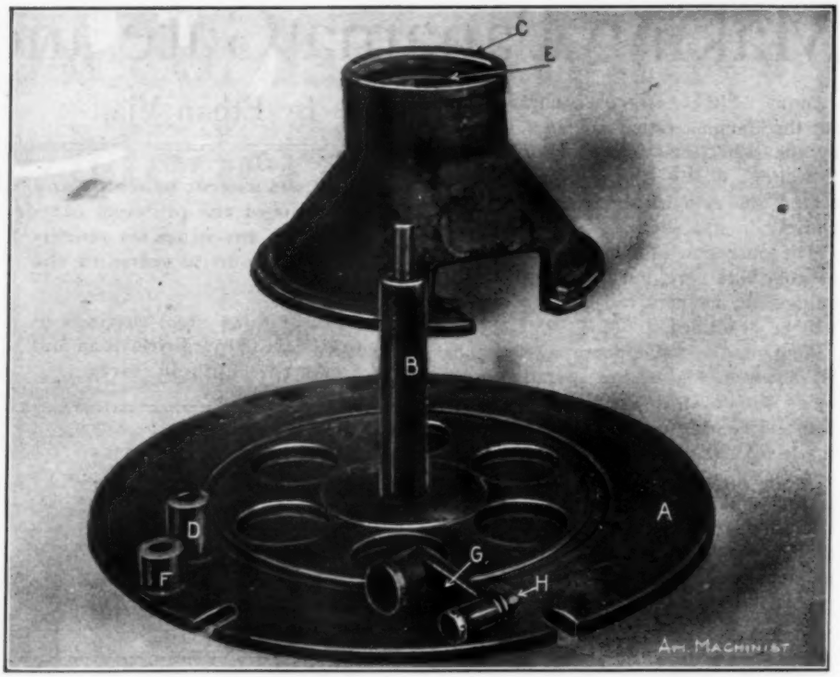


Fig. 2. Bonnet, Locating Plate and Gages

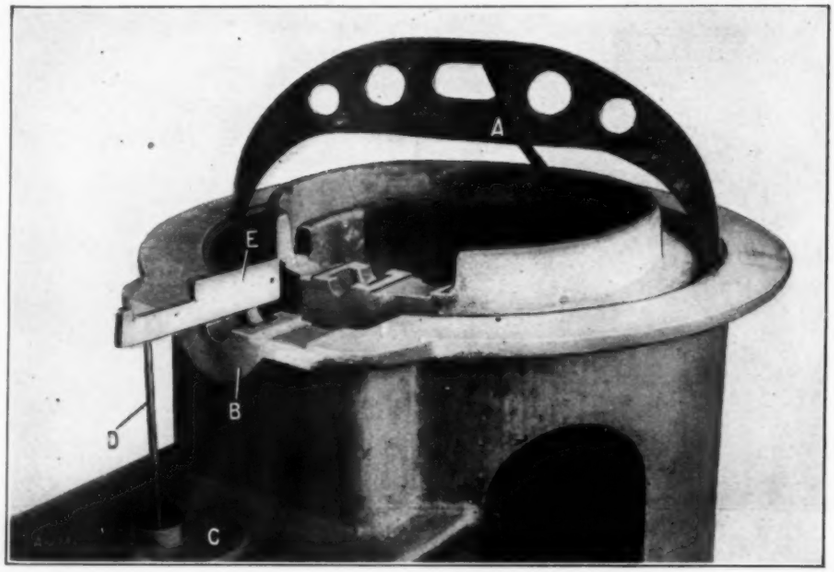
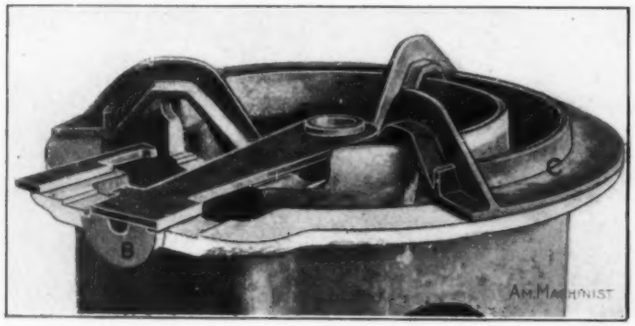
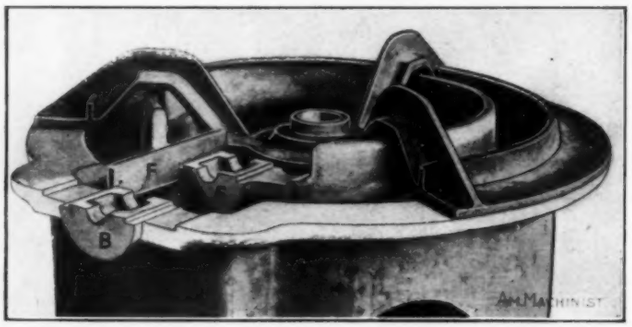


Fig. 5. Gages for Testing Accuracy of Bore





Figs. 6 and 7. Bonnet Seat and Bearing Gages

only finished surface to work from. The casting fits over, and is clamped to the part of the fixture holding the bushings.

There, of course, are three movements necessary beside the feeding of the drill spindles, in order to give the correct positions of the holes to be drilled. The rotation of the cradle has been described, and the spacing of the holes is obtained by moving the drilling heads along the rail, while the cross spacing is done by moving the table to which the fixture is bolted in or out the desired amount.

Owing to the weight of the work and the tough nature of the metal, this fixture is made unusually strong and rigid in order to produce good work.

Planing Beveled Blocks

Large steel castings, which have been beveled on two sides, are planed on the apex while held as shown in Fig. 15. The casting is placed between the two brackets *A* and *B*, with correctly beveled bases, against which they are held by means of the hook bolts *C* and *D*. Additional clamps at *E* and *F* hold the casting firmly to the planer table.

These clamping brackets are also used on the planer table to locate the castings for the planing of the second bevel, after the first has been finished.

Turning Pintle Pins

The pintle pins on which the gates swing are made of nickel steel and when finished are 16 in. in diameter. The forgings from which these are made are large enough to make three pins and they are turned as shown in Fig. 16.

The halftone shows the end pin *A* just being parted from the other two, the wood blocks at *B* and *C* being placed to support the arm as it drops.

The method of supporting and driving the forgings is easily seen. Only the stem and collar of the pin are finished in this operation, the spherical point being finished as shown in Fig. 17.

The pin is held by the stem in a fixture on a lathe faceplate. The cutting tool is carried in the bracket *A*, which swings in a circle on the base *B*, being pulled around by means of the regular cross-slide, to which it is attached by means of the link *C*.

Turning Manhole Covers

Water-tight, steel manhole covers are turned as shown in Fig. 18.

The cover is held in a face-plate fixture, as shown at *A*, by means of set-screws and a bar *B*, braced from the tail center. The carriage movement necessary to cut the oval shaped outline of the seat is obtained by means of a cam *C*, to which the carriage is connected by means of the bar *D*. This cam is on a shaft which is geared to the cone of the lathe.

The method of gearing, and the cam movement are better shown in Fig. 19. In this halftone *A* and *B* are the gears

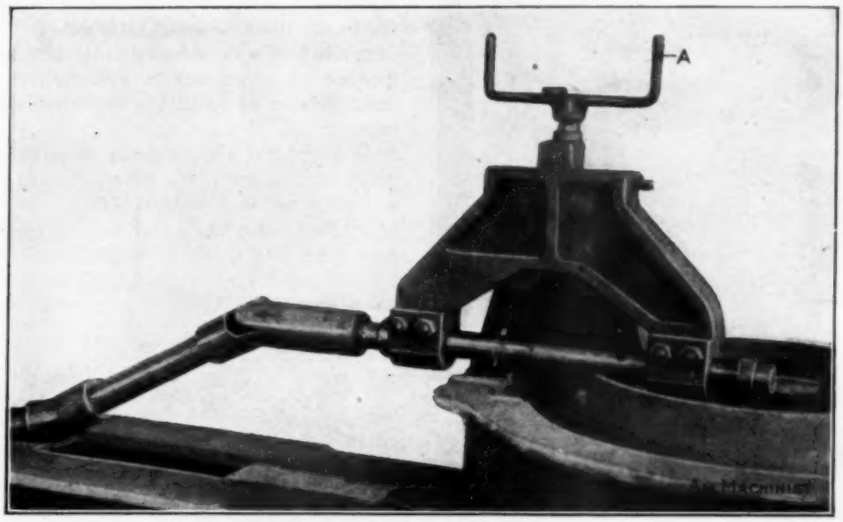


Fig. 8. Fixture for Milling Shaft Bearings

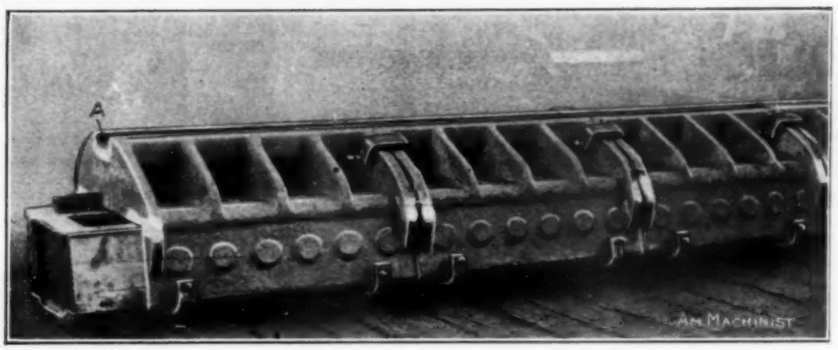


Fig. 10. Row of Reaction Castings Clamped to Planing Jig

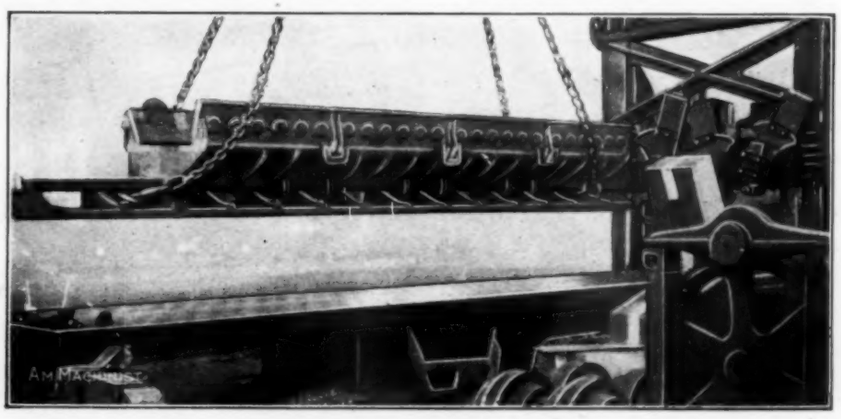


Fig. 11. Group of Castings and Jig Being Swung Onto the Planer Table

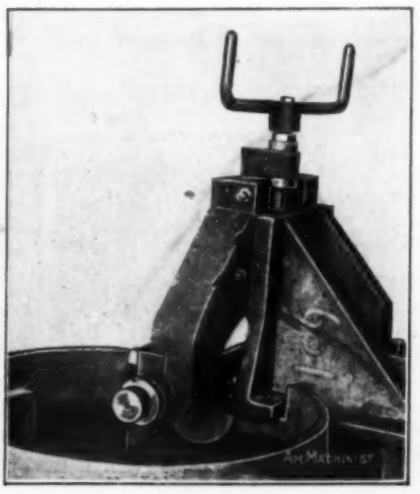


Fig. 9. Back View of Bearing Fixture

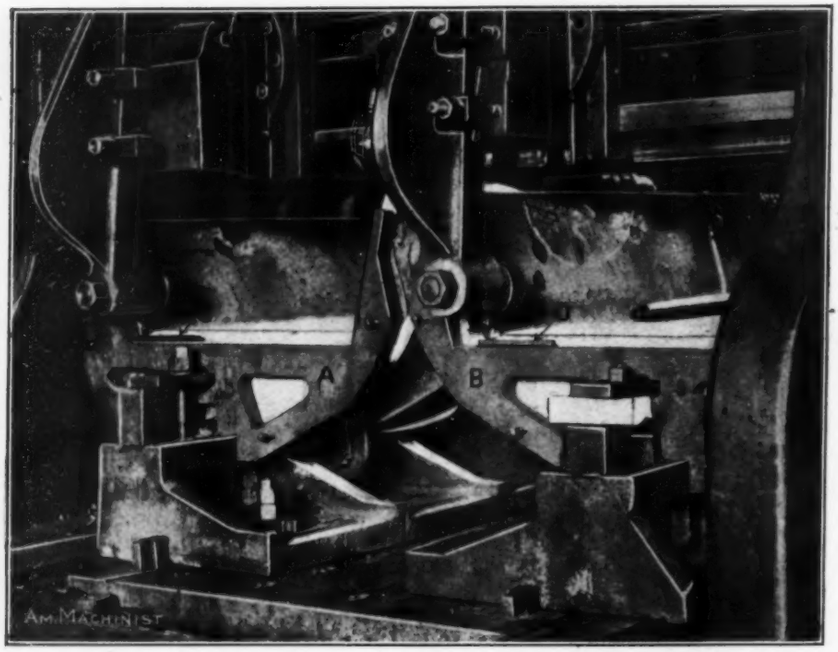


FIG. 12. REACTION CASTING PLANING TEMPLATES AND TOOLS

groove, and in order to keep the bar from being sprung out of line by the action of the cam on the roller, the bar is slotted at *G* so that it can slide back and forth on the shaft *C* as the cam turns. A spring *H* attached to the roller bar at *I* is used to take up lost motion.

System in the Toolroom

BY E. A. ERMOLD

In this age the head of the modern toolroom is compelled to systematize his department to the smallest detail, in order to get the uniformly accurate results demanded. To do this, he resorts to all manner of expedients to systematize a large number of small but important details.

As alloyed steels are being extensively used, he also finds it is necessary to use and keep on hand at least a small stock of no less than six different brands of steel. As each different kind of steel requires a different treatment, it is very necessary not to get them mixed. In order to prevent any confusion of this

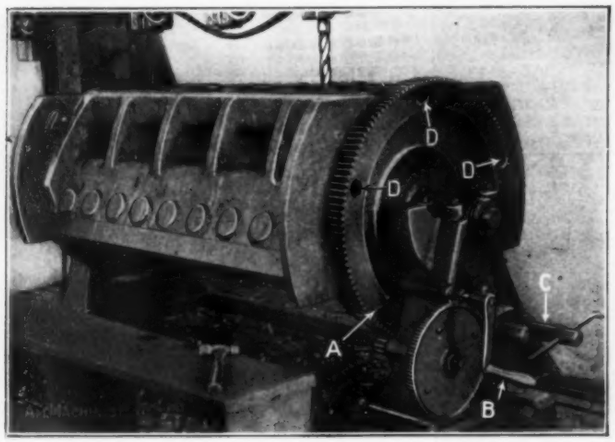


FIG. 13. REACTION CASTING DRILLING FIXTURE

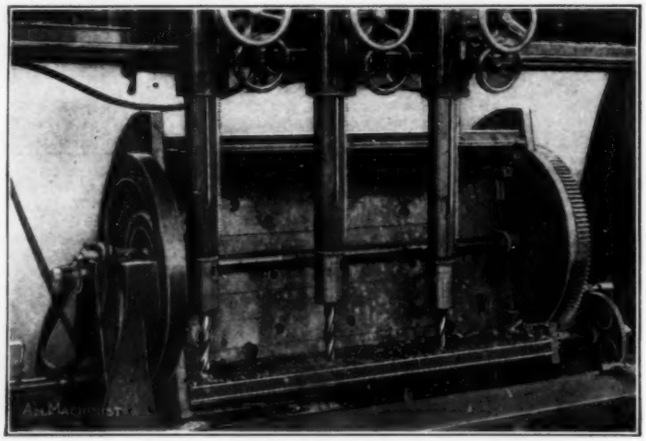


FIG. 14. FIXTURE IN DRILLING POSITION

that connect the shaft *C* to the lathe spindle; *D* is the cam groove and *E* is the bar connected to the tool carriage cross-slide. This bar carries a roller bolted on at *F*, which travels in the cam

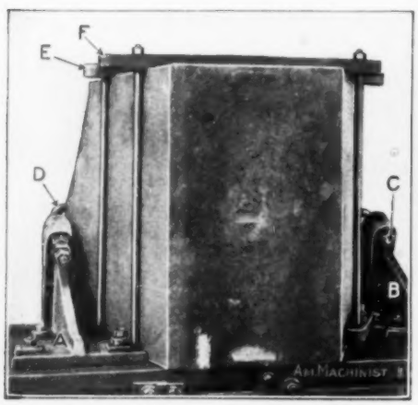


FIG. 15. HOLDING BLOCKS ON PLANER

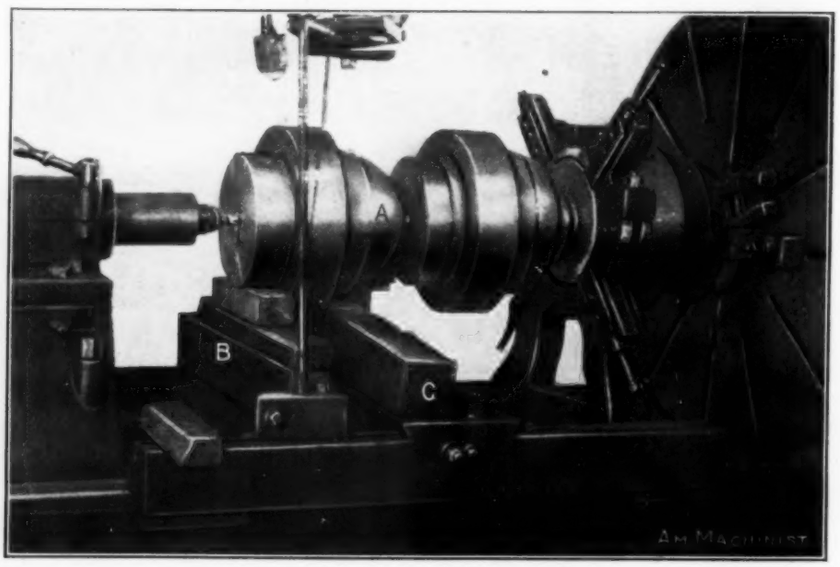


FIG. 16. TURNING PINTLE-PIN FORGINGS

kind, we have adopted a system which has worked so well that the details should prove of interest to others.

As the new alloyed steels are expensive, we aim to carry as small a stock as is consistent with good shop practice. As a result, we order a large number of pieces cut to size, each piece being ordered for a particular job. As it takes the mill three or four weeks to fill orders, we are compelled to anticipate our wants. As we have so many pieces on order at one time, we would not know what jobs the steel was for when it arrived unless some record was kept.

To keep this record, we have adopted the form of card shown in Figs. 1 and 2, the size being 4x6 in., which is the uniform size of all the cards in our index. It will be noticed they are indexed under the heading "Steel;" in the upper left-hand corner is the name of the brand of steel and in the right-hand corner is given the distinctive color which the bar or pieces of that brand are immediately painted when received.

When a piece of steel is ordered, the date is stamped on the proper card under the "ordered" column, the size is marked in the proper column, also the particular job for which it is ordered is indicated in the column allotted for that purpose. When the steel is received, it is identified by its size by reference to the card index, then the date is stamped in the "received" column opposite the proper entry, and the bar painted its entire length with a wide stripe of the distinctive color of that steel, if it happens to be bar steel. If it is a piece of steel and ordered for a particular job, it is painted, tagged and placed in the proper bin.

Each kind of steel has a separate bin, each bin bearing a sign, the background of which is also painted the distinctive color, and the name of the brand of steel is stenciled in large black letters upon it. This sign has been a large factor in reducing mistakes, for all the toolroom attendant has to do when a bar of steel is returned is to place it according to the color, regardless of the name. Mistakes are thus obviated, as it would be very noticeable if a bar painted red were placed among a lot painted green.

In the upper right-hand corner, in Fig. 1, is shown the abbreviation for this

FIG. 17. FINISHING SPHERICAL ENDS OF PINTLE PINS

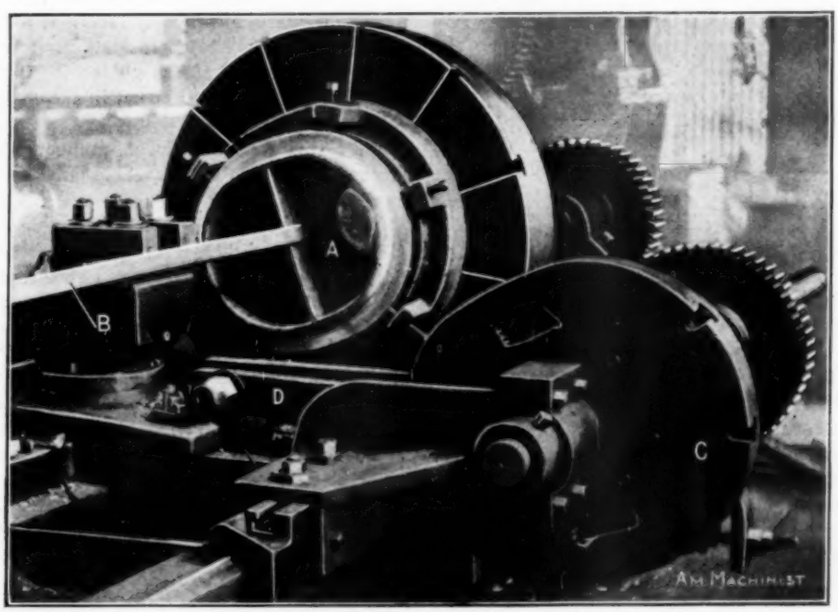


FIG. 18. TURNING WATER-TIGHT MANHOLE COVERS

System in the Toolroom

Card., 1+ *Steel* *Abbreviation*, S.D.S.
Name, Double special *Color*, Dark green

Ordered	Received	Size	Ordered for
Jun 1, 1911	Jul 18, 1911	4 ft. x 1¼" round annealed	Stock
Jun 1, 1911	Jul 18, 1911	4 ft. x 1¼" round annealed	Stock
Jun 1, 1911	Jul 18, 1911	4 ft. x 1¼" round annealed	Stock
Jun 2, 1911	Jul 18, 1911	4-3¼ d. x ¼ annealed disks	1511-B, 1614 J, 2 for stock
Jun 2, 1911	Jul 18, 1911	4-3¼ d. x ⅛" annealed disks	2007-B, 2009-A, 2 for stock
Jun 20, 1911	Aug 10, 1911	4-2¼x⅛" annealed disks	1610-A, 1610-C, 2 for stock
Jun 20, 1911	Aug 10, 1911	4-2¼x⅛" annealed disks	1224-A, 1420-B, 2 for stock
Jun 20, 1911	Aug 10, 1911	4-2¼x¼" annealed disks	2019-C. 3 stock
Jul 31, 1911	Sep 20, 1911	2-3¼x1¼" annealed disks	2016-A. 1 for stock
Jul 31, 1911	Sep 20, 1911	2-3¼x1¼" annealed disks	2016-C. 1224-B.
Jul 31, 1911	Sep 20, 1911	2-3¼x1" annealed disks	2017-D. 1 for stock
Jul 31, 1911	Sep 20, 1911	2-3¼x¼" annealed disks	2017-C. 1 for stock

FIG. 1. FRONT OF CARD

Base Price, 35c. per lb.
Hardening Heat, 1450° F.
Coolant, Brine
Principal Uses, Circular forming tools, reamers, taps and dies.

Remarks, A flat drill made from S.D.S. steel, worked well for drilling hard rubber shells for 1603-C. Sept. 10, 1911.

FIG. 2. BACK OF CARD

brand of steel. It is used in marking all tools made from this steel, and it is our unvarying rule to mark all tools with the proper abbreviation, the object of which is apparent.

In Fig. 2 is shown the reverse side of the card, which is used to keep a record of any data pertaining to the heat treatment of that steel, the proper hardening heat, the best coolant, etc. The particular purposes for which this steel is used is noted, and if any new uses are found, they are jotted down. Continued reference to this side of the card when ordering steel is an excellent way of freshening the memory as to the uses of this steel. When a card is filled up, a new one is made out. The cards are numbered consecutively, a plus sign being placed after the number on the last one when a new one is made out.

Since the inception of this system, we have extended it, so that now we are able to keep a record of all supplies used in the shop which have been requisitioned, and in the case of taps, dies, drills, files, etc., we are able to keep a perpetual inventory and by referring to the card index can tell in a moment if a particular article is on order. With a stock minimum marked on the card, the storekeeper can tell when to reorder.

Making an Accurate Flywheel

By F. N. Raymond

The illustration shows a section of a device recently used on a Pratt & Whitney screw machine.

The work, a flywheel, had to be very accurate. Several hundred were required. It was first chucked by the hub; the outer diameter, side, arms, hub and hole were finished with turret tools. The device was then used to finish the opposite side, arms and hub.

The disk chuck and closer were taken from a standard Rivett bench lathe. The other parts were made to suit the screw machine. The cut clearly shows their construction.

The shank, being caught in collets of the screw machine, the slots wedged and the tension applied through the draw-in sleeve, a finish cut was taken at *A* and *B*. The results were very satisfactory; the metal being removed with the usual turret tools in good time, inaccuracies were less than 0.001 in., which was allowable. So much was thought of this tool that it has been made a part of the screw-machine equipment of this particular shop.

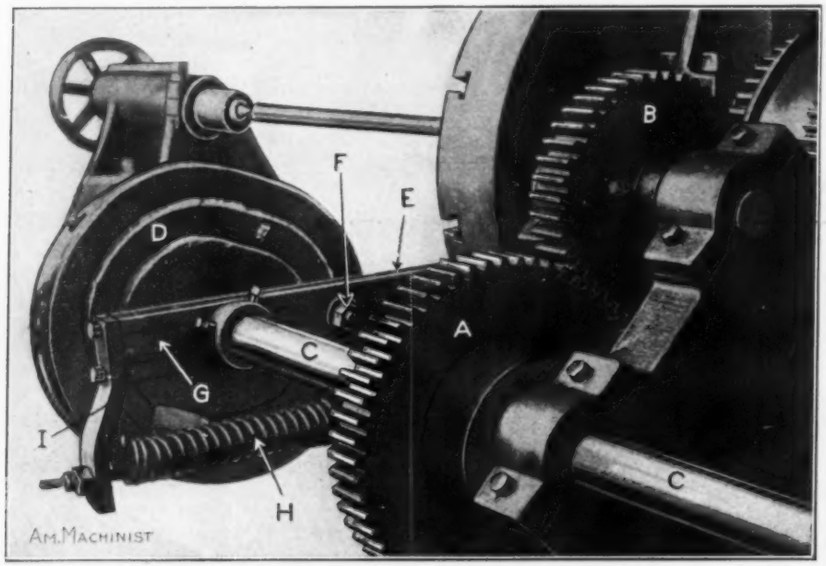
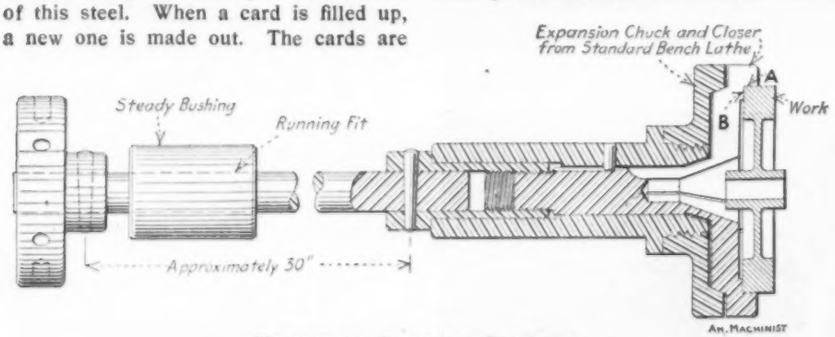


FIG. 19. DETAILS OF THE CAM MOVEMENT



MAKING AN ACCURATE FLYWHEEL

A Clever Device for Slotting Washers in a Keyseater

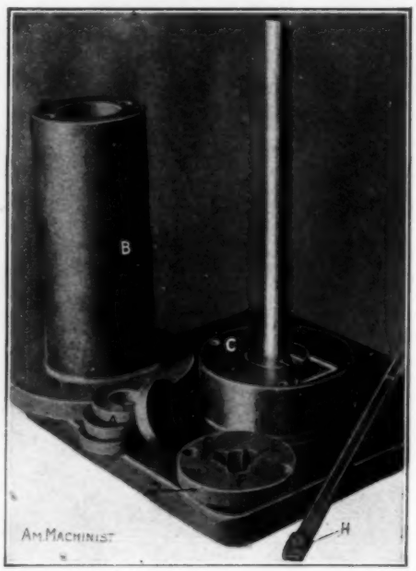
By E. C. Allen

A clever scheme is used in the shop of the McConnell-Browning Engineering Co., Richmond, Va., for cutting three internal slots in a quantity of heavy washers or collars.

Four of the washers are shown at *A* in the cut; *B* is a cast-iron sleeve which, when in use, is bolted to the top *C*, of the regular keyseater. This sleeve is bored out and is of sufficient length to hold 20 washers and have about ¼ in. of length to spare.

On top of the washers the flanged cap *D* is placed, and bolted down with two capscrews, the plug part of *D* being long enough to accurately center it and also clamp the washers securely inside of the sleeve. The cap has three slots in it at *E*, *F* and *G*, which act as guides for the special shaped cutter *H* used in the machine.

With this device a large number of pieces can be finished quickly and accurately.



WASHER SLOTTING FIXTURE

In a report to the secretary of the Department of Commerce and Labor the director of the Bureau of Standards says that during the last fiscal year the number of tests increased to considerably more than double that of the previous annual period. The growth is attributed to the steadily increasing interest of the industries in applying scientific data and principles to manufacturing. A noteworthy feature of the year's progress has been in the investigation and testing of structural materials. The completion of extended investigations affecting the fundamental electrical units and standards is also of special interest.

Standardizing Elementary Parts*

By Rudolph L. Hanau†

The work of the designer and draftsman can be simplified and shortened by using standards for the elements of machine parts, such as hubs, bosses, yokes, lever webs, etc. There are important advantages in this course to designer, builder and user of special machines. A few such standards are suggested, and the way in which they are derived and used is shown.

The standardization of the elementary parts of special machines is an almost neglected subject. The matter has not been investigated and put into use in drawing rooms and shops, nor has it been adequately treated in the technical journals. The reason for this is that very few standards exist that are applicable to elementary parts. It appears that nearly every designing engineer has his own methods of work and ideas of proportion, and pays very little, if any, attention to the important feature of uniformity among the parts that he designs.

It is the purpose here to call attention to this deplorable condition, to suggest a way that will lead to improvement, and to point out the advantages that such improvements will bring to all of the interested parties—designer, builder and user of special machinery.

General Standards

There are only a few general machine standards, and unfortunately these are not used as widely as they should be. A single illustration of this is all that is needed. The United States standard for screw threads has been recognized in this country for some 40 years. At a recent meeting of the American Society of Mechanical Engineers it was brought out that today only 53 per cent. of the hand taps produced have United States standard threads. That is, this important standard is apparently being used in only about one-half of the holes tapped in the machine shops of this country. Yet this is one of the first standards that the designer of special machines should adopt.

Most of the large machine-building companies of this country have machine part standards of their own. These usually cover screws, nuts, bolts, washers, taper pins, rollers, studs, and perhaps bearings, gears, pulleys and some other parts. Some of these proportions are fixed by the manufacturing standards of firms who market small parts, such as screws, washers, rivets and the like. The others have been set up by the firms for their own use. The latter are usually carefully guarded.

Standardizing Elementary Parts

At first thought it may not appear that there are many standards which can be adopted in designing and building special machines. Such is not the case, however. All of the recognized general standards can, and should be adopted and used. It is unnecessary to mention these in detail. In addition to these, manufacturers' standards should be followed; that is, for small parts such as can be purchased in the open market.

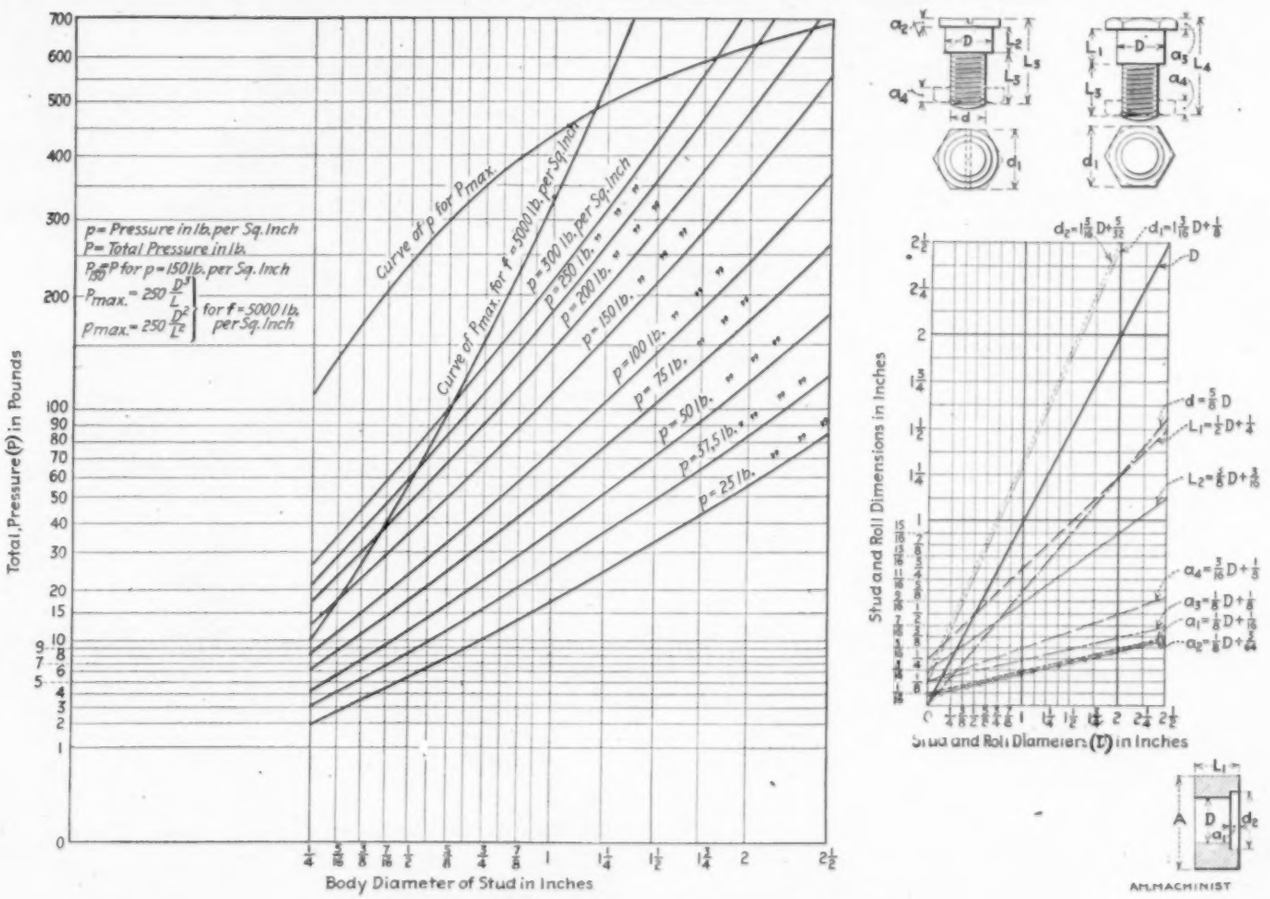

Total Pressure (P) in Pounds
Body Diameter of Stud in Inches
p = Pressure in lb. per Sq. Inch
P = Total Pressure in lb.
P/150 = P for p = 150 lb. per Sq. Inch
Pmax. = 250 D³/L
Pmax. = 250 D²/L² for f = 5000 lb. per Sq. Inch
Curve of P for Pmax.
Curve of Pmax. for f = 5000 lb. per Sq. Inch
p = 300 lb. per Sq. Inch
p = 250 lb. " " "
p = 200 lb. " " "
p = 150 lb. " " "
p = 100 lb. " " "
p = 75 lb. " " "
p = 50 lb. " " "
p = 37.5 lb. " " "
p = 25 lb. " " "
Stud and Roll Dimensions in Inches
Stud and Roll Diameters (D) in Inches
d = 5/8 D
L1 = 1/2 D + 1/4
L2 = 3/8 D + 3/16
a4 = 3/16 D + 1/8
a3 = 1/8 D + 1/8
a1 = 1/8 D + 1/16
a2 = 1/8 D + 1/64
A
AM MACHINIST

FIG. 1. DESIGNING CHARTS FOR STUDS AND ROLLS

Beyond this is the opportunity of standardizing elementary parts, such as cam rollers, studs, fulcrum pins, bush-

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†Mechanical Engineer, Hanau Engineering Co., 74 Lafayette St., New York City.

ings, handwheels, crank handles, and the like. This elementary standardization can be carried still further by having fixed proportions for hubs, bosses, yokes, rod ends, link ends, and the like.

From these standard elements, levers, links, bell cranks, pull and push rods and similar parts can be designed with little trouble and in uniformity. It can almost be said that all the parts of a special machine, except the frame, cams and work-handling parts, can be built up of these elementary standards.

Such uniformity will in nowise sacrifice any of the important features of successful design. Every intelligent analysis of a given problem, followed by a careful layout of a machine for the work intended, should lead to similar part proportions and similar dimensions. This elementary standardization means that the designer goes through his theoretical investigation once, records his results, and then makes use of them as the same or similar problems come before him again.

Further, the original determination of these parts can be made from an investigation of the best theoretical and practical sources. Parts working successfully on special machines can be studied and analyzed, and from this mass of information clear deductions made, giving a uniform standard design, upon which the designer can rely. The proportions are from matured judgment, not snap decisions.

Advantages of Such Standardization

It was mentioned that this standardization has advantages for designers, builders and users of special machines. Taking up these advantages in order, it is true that the efficiency of the average designing and drawing office is much below what it might be. This standardization is one means of greatly increasing the quantity and quality of drawing-room output, especially in the design of special machines. The chief designer can merely indicate general dimensions, specifying that such and such standard or elementary parts are to be used.

A comparatively inexperienced designer can finish the design and carry through the detailing. He does not have to spend any time in determining dimensions and proportions, the work that today demands by far the greater part of his effort. These he takes from standard tables. Thus his output for a unit of time will be much greater than if he has to determine sizes and dimensions as he goes along, many of which are mechanically unimportant.

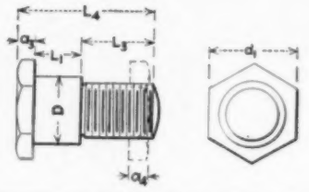
Furthermore, the chief designer is sure of the proper proportions of all of these parts, knowing that they have been carefully predetermined from the best of theoretical and practical considerations.

The advantages to the shop lie in the uniformity of sizes such as bosses, hubs and the like, permitting uniformity in machining operations, and in the use of special tools. This is a far more important point than may appear on the surface. A machine thus standardized can be built for less money than one lacking in such uniform features.

Duplicate manufacture is recognized as a fundamental element of design where machines are to be built in quantities. The user of a special machine which has been designed for his own use, or for sale, may wish to manufacture this machine in quantities at any time. If the original design has been so standardized in its elementary parts, the problem of redesign to meet manufacturing conditions is vastly simplified. The production of parts for changes and repairs for a special machine, the design of which is unified is a simpler and cheaper proposition than for a machine that is entirely special.

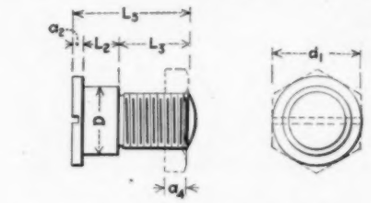
Furthermore, if a number of machines are developed for the same purchaser and user, it is to his advantage to have the parts throughout standardized so far as it is possible. This is true with machines that are similar but of various sizes of a given kind or type, or are entirely dissimilar, through entering into the same manufacturing plant.

It is unfortunately true that some of the



NOM. SIZE	L_4	a_3	L_1	D	L_3	d_1	a_4	THREAD
1/4	1 1/8	7/16	0.377	0.249	3/16	11/32	3/16	1/4 × 24
5/16	1 3/16	1/2	0.408	0.311	3/8	1/2	3/16	1/4 × 24
3/8	1 15/64	3/16	0.439	0.374	21/32	9/16	3/16	5/16 × 18
7/16	1 21/64	3/16	0.470	0.436	23/32	5/8	7/32	3/8 × 16
1/2	1 7/16	3/16	0.502	0.499	3/4	23/32	7/32	7/16 × 14
5/8	1 5/8	3/16	0.564	0.623	27/32	7/8	1/4	1/2 × 13
3/4	1 23/32	7/32	0.627	0.748	15/16	1	1/4	9/16 × 12
7/8	1 63/64	7/32	0.690	0.873	1 1/16	1 5/32	5/16	5/8 × 12(11)
1	2 1/8	1/4	0.752	0.998	1 1/8	1 5/16	5/16	3/4 × 12(10)
1 1/4	2 15/32	9/32	0.877	1.248	1 5/16	1 5/8	3/8	1 × 12(8)
1 1/2	2 3/4	5/16	1.002	1.498	1 7/16	1 7/8	3/8	1 1/4 × 12(7)
1 3/4	3 3/32	11/32	1.127	1.748	1 5/8	2 3/16	7/16	1 1/2 × 12(6)
2	3 7/16	3/8	1.152	1.998	1 13/16	2 1/2	1/2	1 3/4 × 12(5)

Fig. 2. Proportions of Hexagon-head Studs



NOM. SIZE	L_5	a_2	L_2	D	L_3	d_1	a_4	THREAD
1/4	61/64	5/64	0.282	0.249	3/16	13/32	3/16	1/4 × 24
5/16	1 1/64	5/64	0.313	0.311	5/8	1/2	3/16	1/4 × 24
3/8	1 5/64	5/32	0.330	0.374	21/32	9/16	3/16	5/16 × 18
7/16	1 11/64	3/32	0.360	0.436	23/32	5/8	7/32	3/8 × 16
1/2	1 15/64	7/64	0.376	0.499	3/4	23/32	7/32	7/16 × 14
5/8	1 25/64	1/8	0.423	0.623	27/32	7/8	1/4	1/2 × 13
3/4	1 35/64	9/64	0.470	0.748	15/16	1	1/4	9/16 × 12
7/8	1 47/64	5/32	0.518	0.873	1 1/16	1 5/32	5/16	5/8 × 12(11)
1	1 59/64	11/64	0.564	0.998	1 1/8	1 5/16	5/16	3/4 × 12(10)
1 1/4	2 11/64	13/64	0.658	1.248	1 5/16	1 5/8	3/8	1 × 12(8)
1 1/2	2 27/64	15/64	0.752	1.498	1 7/16	1 7/8	3/8	1 1/4 × 12(7)
1 3/4	2 47/64	17/64	0.845	1.748	1 5/8	2 1/16	7/16	1 1/2 × 12(6)
2	3 3/64	19/64	1.189	1.998	2 1/16	2 1/2	1/2	1 3/4 × 12(5)

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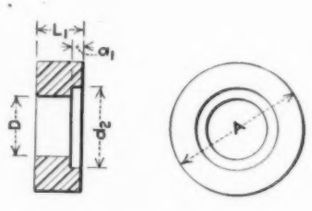
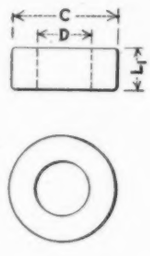
Fig. 3. Proportions of Round-head Studs



NOM. SIZE	D	L_1	a_1	d_2	A
1/4	1/4	5/8	3/32	7/16	7/8
5/16	5/16	13/32	3/32	17/32	1
5/8	3/8	7/16	7/64	19/32	1 1/8
7/16	7/16	15/32	7/64	21/32	1 1/4
1/2	1/2	1/2	1/8	3/4	1 3/8
5/8	5/8	9/16	9/64	29/32	1 5/8
3/4	3/4	5/8	5/32	1 1/32	1 7/8
7/8	7/8	11/16	11/64	1 3/16	2 1/8
1	1	3/4	3/16	1 11/32	2 3/8
1 1/4	1 1/4	7/8	7/32	1 61/32	2 7/8
1 1/2	1 1/2	1	1/4	1 69/32	3 3/8
1 3/4	1 3/4	1 1/8	9/32	2 7/32	3 7/8
2	2	1 1/4	5/16	2 17/32	4 3/8

Fig. 4. Proportions of Cam Rollers



NOM. SIZE	D	C	L_1	TAPER PIN NO.	SET SCREW
1/4	1/4	5/8	5/8		
5/16	5/16	3/4	13/32		
3/8	3/8	7/8	7/16		
7/16	7/16	1	15/32		
1/2	1/2	1 1/16	1/2	0-1 1/16	
5/8	5/8	1 5/16	19/16	2-1 5/16	
3/4	3/4	1 1/2	5/8	3-1 1/2	1/4 × 20
7/8	7/8	1 3/4	11/16	4-1 3/4	1/4 × 20
1	1	2	3/4	5-2	5/16 × 18
1 1/4	1 1/4	2 5/8	7/8	6-2 5/8	5/16 × 18
1 1/2	1 1/2	2 5/8	1	7-2 7/8	3/8 × 16
1 3/4	1 3/4	3 1/4	1 1/8	8-3 1/4	1/2 × 12
2	2	3 3/4	1 1/4	8-3 3/4	1/2 × 12

Fig. 5. Proportions of Collars

foremost designers of special machines in this country make no effort whatever to get uniformity in similar parts of their designs. Instead of developing consistent design after design, each one seems to be considered alone without reference to anything else in the universe.

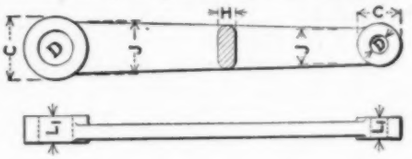
Developing Elementary Standards

To show how such elementary standards are established, a practical example is here given, showing the calculations and methods leading up to preparing tables of dimensions for cam-roll studs and cam rolls. The reference is to the larger chart, Fig. 1.

Let

D = Body diameter of stud in inches,

L = Body length of stud in inches,



NOM. SIZE	D	C	L_1	TAP	H	J
1/4	1/4	5/8	5/8	1/4×24	5/16	1/2
5/16	5/16	3/4	15/32	1/4×24	5/16	5/8
3/8	3/8	7/8	7/16	5/16×18	5/16	11/16
7/16	7/16	1	13/32	3/8×16	5/16	15/16
1/2	1/2	1 1/16	1/2	7/16×14	5/16	7/8
5/8	5/8	1 5/16	9/16	1/2×13	11/32	1
3/4	3/4	1 1/2	5/8	9/16×12	3/8	1 3/16
7/8	7/8	1 3/4	11/16	5/8×12(11)	15/32	1 3/8
1	1	2	3/4	5/8×12(10)	7/16	1 9/16
1 1/4	1 1/4	2 1/8	7/8	1×12(8)	1/2	1 7/8
1 1/2	1 1/2	2 7/8	1	1 1/4×12(7)	1/2	2 1/4
1 3/4	1 3/4	3 1/4	1 1/8	1 1/2×12(6)	9/16	2 5/8
2	2	3 3/4	1 1/4	1 3/4×12(5)	5/8	3

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Fig. 6. Proportions of Simple Levers

d = Root diameter of screw thread in inches,

P = Total journal pressure on body in pounds,

p = Unit journal pressure (pounds per square inch),

f = Maximum allowable fiber stress in pounds per square inch.

We wish to determine values D, L and d, and fix the other proportions of the studs and rolls in terms of them.

The bending moment in the body of the stud, considering it as a simple cantilever, is:

$$M_b = \frac{PL}{2}$$

The bending moment of the section at the root of the thread is

$$M_d = \frac{f}{\frac{d}{2}} \frac{1}{64} \pi d^4 = \frac{f \pi d^3}{32}$$

These bending moments must be equal. Equating them we have

$$\frac{PL}{2} = \frac{f \pi d^3}{32}$$

$$P = \frac{0.2 f d^3}{L} \text{ (approx.)}$$

It is good practice to take f at not more than 5000 lb. per sq.in. for the grades of steel commonly used in such studs. Furthermore, to get a satisfactory shoulder between the thread and body

$$d = \tfrac{5}{8} D$$

and

$$d^3 = 0.25 D^3$$

Substituting these values in the preceding equation giving the value of P we have:

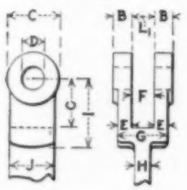
$$P = \frac{0.2 \times 0.25 D^3 \times f}{L} = 250 \frac{D^3}{L}$$

But

$$P = p D L$$

Then

$$p = \frac{250 D^2}{L^2}$$



NOM. SIZE	L_1	B	C	D	E	F	G	H	I	J
1/4	5/8	25/64	5/8	1/4	1/4	5/8	7/8	5/16	13/16	1/2
5/16	15/32	31/64	3/4	5/16	1/4	13/32	29/32	5/16	1	5/8
3/8	7/16	11/32	7/8	3/8	1/4	7/16	15/16	5/16	1 1/16	11/16
7/16	1/2	45/64	1	7/16	1/4	15/32	31/32	5/16	1 1/8	15/16
1/2	9/16	1/2	1 1/16	1/2	1/4	1/2	1	5/16	1 7/16	7/8
5/8	5/8	5/8	1 1/16	5/8	1/4	25/32	1 7/32	11/32	1 1/4	1
3/4	5/8	7/8	1 1/2	3/4	3/32	1 5/16	1 11/32	3/8	1 7/8	1 3/16
7/8	11/16	15/16	1 3/4	7/8	3/32	7/8	1 25/32	13/32	2 3/16	1 3/8
1	3/4	1/2	2	1	3/32	15/16	1 29/32	7/16	2 1/2	1 9/16
1 1/4	7/8	9/16	2 5/8	1 1/4	1/32	1 1/16	1 15/32	1/2	2 7/8	1 7/8
1 1/2	1	5/8	2 7/8	1 1/2	1/8	1 1/4	2	1/2	3 3/8	2 1/4
1 3/4	1 1/8	11/16	3 1/4	1 3/4	1/8	1 1/2	2 7/32	5/8	3 7/8	2 5/8
2	1 1/4	3/4	3 3/4	2	1/8	1 3/4	2 7/16	5/8	4 1/4	3

Fig. 7. Proportions of Plain Yoke Ends

This expression gives the relation between p, D and L.

It will be noted that the value for f is low, 5000 lb. per square inch. This is in keeping with good practice for several reasons. Cam-roll studs are abused both in erecting and in use. The hammer is a frequently used erecting tool. Improper hammering may set up stresses far beyond any that are calculated.

As for care, how often do we see the matters of adjustment and lubrication of cam-roll studs properly attended to? Very seldom. Moreover, the quality of the stock is beyond the control of the designer as well as the treatment it receives, particularly in hardening and drawing.

Having determined the value of P, the total pressure on the body of the stud in terms of D and L, we are now ready to prepare a chart to aid us in designing.

A satisfactory relation between L and D is expressed by the equation

$$L_1 = \tfrac{1}{2} D + \tfrac{1}{4}''.$$

This is for a stud suitable for the fulcrum for a lever and similar service. It is called a long stud and is shown in the extreme upper right corner of the chart. Using this relation for L and D, the equation

$$P_{max.} = 250 \frac{D^3}{L}$$

is plotted into the curve of the chart so marked. The corresponding pressures and stud diameters picked off from this line give the maximum total pressure that a stud of the given diameter and length equal to $\tfrac{1}{2}D + \tfrac{1}{4}$ in. will support.

The upper curve in the chart is plotted for the unit pressures corresponding to the maximum total pressures. It is from the equation

$$p = 250 \frac{D^2}{L^2}$$

These two curves take into account only the strength of the stud when stressed to 5000 lb. per square inch maximum fiber stress. In designing, the unit pressure on the body or journal of the stud must be taken into account. To aid the designer in considering this factor nine lines have been added to the chart, each for a specific bearing pressure. The range is from 25 to 300 lb. per square inch.

To show how these lines are used, a stud $\tfrac{5}{8}$ in. in diameter under a load of 200 lb. per square inch will sustain a total load of 70 lb. The way in which this is traced out is easily seen. On the other hand if we follow the vertical line for a $\tfrac{5}{8}$-in. stud to its intersection with the line of P_{max} we find that it will sustain a total load of 100 lb. corresponding to a unit pressure of 300 lb.

This unit pressure is too high for our requirements and, therefore, the stud will be stressed in use less than 5000 lb. per square inch. This quantity is read from the right-hand scale horizontally in line with the intersection of the vertical from the $\tfrac{5}{8}$-in. stud and the curve of p for P_{max}.

Taking another example: If a load of 40 lb. is to be carried, what diameter of stud will be necessary for a specific bearing pressure of 250 lb. per square inch? From the chart we find the corresponding stud diameter of $\tfrac{3}{8}$ in. But the intersection giving this value is above the P_{max} curve, so we must reduce our specific pressure. Following to the right along the horizontal we reach the vertical for a stud diameter of $\tfrac{7}{16}$ in. This is below the P_{max} curve and corresponds to a specific pressure of 200 lb. per square inch.

Turning to Fig. 1, a short stud is shown in the upper right-hand corner. The proportion of length to diameter is expressed by the equation

$$L_2 = \tfrac{3}{8} D + \tfrac{3}{16}$$

The proportion of lengths is as 1 to 0.75 for the long and short studs, respectively. Thus for a given diameter and unit pressure, the short stud will sustain three-fourths of the load of the long one approximately.

The selection of unit pressures for specific cases cannot be discussed here, for too many things affect it. However, a few reasons which occasion the selection of low specific pressures may be given with profit. These are: A lack of lubrication; lack of proper care; clogging of oil grooves with foreign substances, especially those that are gritty; squeezing out of the oil if the pressure is too high; with small diameters it is difficult to provide suitable means for storing and distributing oil; minimum wear comes from low unit pressures. From the last three items it follows that for similar conditions smaller bearings should have lower specific pressures than larger ones.

Factors of Proportion

Turning again to Fig. 1, at the right is a small chart having curves for the various dimensions of cam rolls and long and short studs, both hexagon and slotted heads. Each curve has its equation. From this chart consistent tables of roll and stud dimensions have been prepared. These are shown in Figs. 2, 3 and 4. Explanation of them is unnecessary except to state that they apply to parts made of cast iron.

Three other tables of dimensions of elementary parts are shown in Figs. 5, 6 and 7. They are for collars, levers, and yokes, respectively.

How Elementary Standards Are Used

The way in which these standards are used in designing is best illustrated by an example. Assume that we wish to detail the parts of a lever and link motion consisting of a bell crank, link and lever as shown in Fig. 8. Here are given center distances and the nominal diameters of the connecting studs. This information is all that is needed.

To find the dimensions for the various bosses, turn to Fig. 6. The master column of the table is headed "nominal size." This is the size of the hole through the boss. The other columns give the outside diameter and thickness of the boss and the width and thickness of the web of the lever springing out of it. From this table can be taken all of the dimensions necessary to design the lever and link.

The bell crank has one forked end, or a yoke. The dimensions for this are taken from Fig. 7. Similarly, the studs and cam roll are designed from Figs. 2, 3 and 4.

If the reader will check over the dimensions on the reproduced drawings in Figs. 9, 10 and 11, he will see that they all come from the diagram of Fig. 8 and the tables of Figs. 2 to 7, inclusive.

The ease and speed with which machine parts can be detailed from these elementary standards is surprising. A demonstration is necessary before the full advantages are apparent.

There are further advantages in this method of design besides those that relate merely to the making of the drawings themselves. The uniformity in size of the elements of machine parts is an advantage in machining operations. If such a system is in general use in a plant, elementary parts of patterns, hubs, bosses, and yoke ends can be carried in stock, thus bringing standardization into the pattern shop and tool-making room.

The fundamental ideas in this are, division of the work of making drawings and prior planning of as much of this work as possible. The analytic work of design is done once for all for the elementary details. The results of this analysis are then used with full assurance of uniformity and success. Needless to say, a set of standards must be known to be adapted to the type of machine to be designed, before such standards are used.

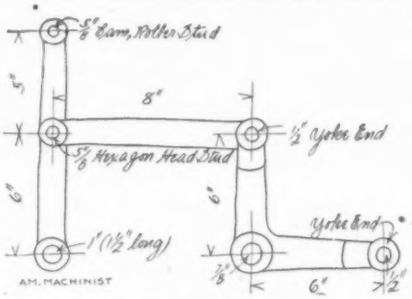


Fig. 8. Designer's Sketch

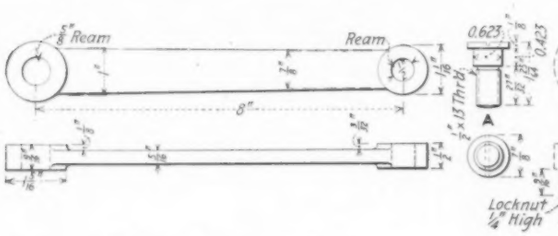


Fig. 9. Detail of Link

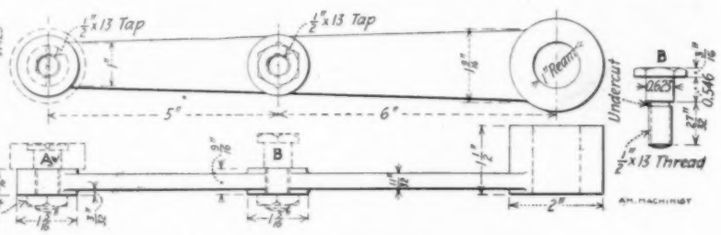


Fig. 10. Detail of Lever

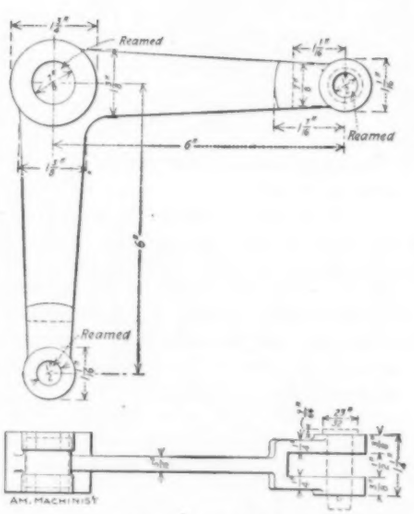


Fig. 11. Detail of Bell Crank

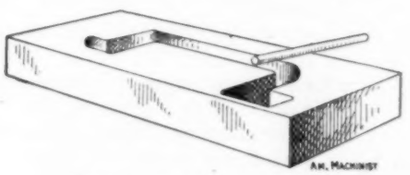
Fitting Punches to Dies

By John P. Grimes

This method describes how the die maker can save several hours on fitting the punch to his die and at the same time secure a first-class fit the full length of the punch.

After filing the die to the template and hardening, grind the die; it is then ready for the punch. After roughing out the punch to a near fit, shear it through the die. You still, however, have a lot of filing to do to make the punch fit. Here is how I do it, or rather make the die do the fitting:

Take a piece of drill rod, or an old file, harden and polish, and rub a burr on the cutting edge of the die. This makes the die 0.001 in. smaller. Then broach the punch through the die and a perfect fit all around is secured. Next grind the die enough to remove the burr, and polish the punch. You thereby save several hours and secure a first-class job.



Fitting Punches to Dies

The 46,000 passenger cars of the railroads of the United States, valued at $300,000,000, are capable of seating at one time 2,300,000 people, and, if pressed for room, would accommodate probably 3,500,000 persons. They transport annually almost 900,000,000 passengers, each of whom rides approximately 33 miles. Practically, therefore, one passenger is hauled 30,000,000,000 miles.

Daylight, Distinctive in Shop Lighting*

By C. E. Clewell†

Daylight, when available, is highly desirable in every shop and should be supplied through the necessary channels, not only from the humane standpoint, but also from the point of view of maximum efficiency.

Some of the general requirements in providing adequate daylight and light control; maintenance problems, cost factors, economic relations to work, etc.

"Better than daylight" is a term frequently heard in these days to designate the excellence of artificial light. There are reasons why such a statement may apply with some truth. Artificial lighting may be controlled with much greater ease in the production of a uniform light, as well as an exact intensity required for a given class of work. Furthermore, artificial lighting is largely independent of exterior conditions, such as clouds, fogs and the like.

These secondary considerations, however, do not cover the entire question of the relative merits which may be set over against each other in the case of artificial and natural lighting. There is certainly an excellence in the qualities of daylight which thus far has not been fully attained by means of electric and gas illuminants. For example: In the excellence of diffusion, the normal color, and perhaps of even more importance, the fact that daylight is the natural condition of vision.

All things considered, therefore, daylight, when available, is highly desirable in every shop and should be supplied through the necessary channels, not only from the humane standpoint, but also from the point of view of maximum efficiency.

*This is the ninth of a series of articles on shop lighting being written by Mr. Clewell for the "American Machinist." There have already appeared in Vol. 34, page 595, "Machine Shop Lighting"; page 686, "Drafting Room Lighting Problems"; and on page 1076, "Foundry Lighting Problems"; in Vol. 35, page 346, "Shop Lighting Design"; page 777, "Shop Lighting Installation"; Vol. 36, page 127, "The Artificial Lighting of Machines"; page 501, "Upkeep of Shop Lighting Systems," and on page 779, "Shop Lighting Maintenance Records."—Editor.

†Lighting expert, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn.

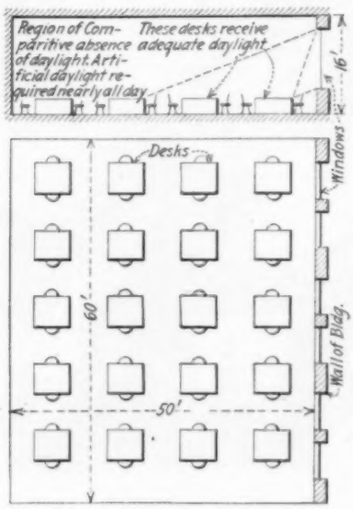


FIG. 1. DIAGRAM OF LARGE OFFICE WITH SIDE WINDOWS ONLY

The unusual and extensive developments in electric shop lighting during the past few years; the great attention which has been centered on the perfecting of various lamps and auxiliaries looking toward the best quantity and quality in lighting effects for given cases; the marked attention which has been devoted to increasing the efficiency in various shop operations, are all items which only emphasize the great advantages and economies of suitable shop windows so as to furnish daylight in the proper quantities and in the right direction for the work during those portions of the day when available.

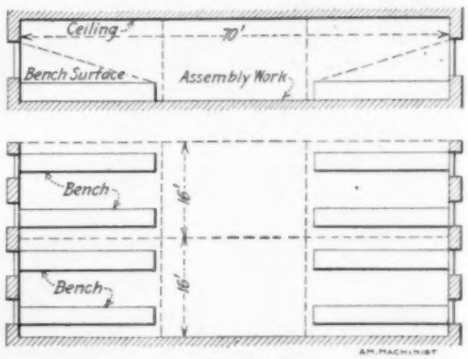


FIG. 2. DIAGRAM SHOWING BENCHES LOCATED WITH RESPECT TO WINDOWS

GENERAL REQUIREMENTS

The study of artificial lighting in relation to shop conditions furnishes a basis from which to draw certain conclusions regarding natural light, as well as the characteristics which it should possess to promote the highest efficiency in the shop, at least as far as shop efficiency may be dependent upon lighting facilities. In artificial lighting, it has been shown that two of the important requirements are sufficiency and continuity.

It will be found, however, in the study of natural light that the effort for sufficiency must be tempered by suitable precautions for the prevention of excessive quantities of light, while continuity is a matter dependent upon conditions entirely beyond the control of human agency.

It would rather concern the shop owner, therefore, to provide adequate window space in the shop building, and to locate and choose the windows so as to prevent the glare of direct sunlight in the eyes of workmen, due to the fact that excessive intensities of direct sunlight on work of a bright or glossy nature cause a blinding effect.

From the viewpoint of economy, no shop can afford to have its employees at work under an insufficiency of light, either natural or artificial, since the losses through a lower production output are found to greatly over-balance any apparent economies, either through a lower first cost in building construction by reducing the window area, or by a saving in electrical energy through a reduction in the number of lamps necessary.

As in the case of artificial lighting, excellence of which is demanded at those times of the day when the continuity of natural light is interfered with by clouds, fog or smoke, and at night, so natural light to be most effective should possess several requirements, as follows:

The light should be adequate for each employee. The windows should be so spaced and located that daylight conditions are fairly uniform over the entire working plane. The daylight intensities should be such that artificial light will be required only during those portions of the day when it might naturally be considered necessary. The windows should provide a quality of daylight which will avoid glare due to the sun's rays shining directly into the eye.

GENERAL CLASSIFICATION

Natural lighting may arbitrarily be classed in three divisions:

As provided through windows located overhead on a horizontal or nearly horizontal plane, thus furnishing direct rays of the sun to the work during a large portion of the day. As furnished through windows located either on the sides of the building or by means of the saw-tooth construction, where the diffused rays of sunlight reach the work during a large portion of the day. As furnished by prismatic devices which take up the direct rays of light and redirect them in those cases where overhead windows are impracticable.

It will be apparent that the second of these divisions possesses many features of importance, and the tendency toward the saw-tooth construction during recent years is evidence of its popularity, both in the quality and the quantity of light provided for given window areas. In practically all cases the side windows of shop buildings furnish a means not only for the transmission of natural light, but also for ventilation. The features of ade-

quate ventilation will, therefore, determine in a partial manner the proper location of shop windows with reference to the working-floor space.

The Relation of Windows and Work

In artificial shop lighting one of the greatest advantages of a so called overhead system is the nondependence of the location of the work upon the lighting system. This feature, which may in itself appear insignificant, is in fact of great importance where the floor space is limited in proportion to the number of workmen employed. Adequate lighting, whether natural or artificial, over the entire floor space means that certain portions of the floor, which ordinarily would not be available for work, are converted into valuable manufacturing space.

The average shop, therefore, if properly designed, should be made to possess natural daylight facilities, equal or nearly equal to those of artificial light in the uniformity and intensities required. Where low ceilings, however, are in evidence, it often happens that workmen must depend entirely for light upon windows located at the sides of the building. This feature will, in some cases, make it practically impossible to depend altogether on daylight over an entire floor space, even at those times of the day when daylight conditions would be entirely adequate were the windows more advantageously located.

An example will serve to illustrate this point: In a certain large office, as shown in Fig. 1, with a ceiling height of 16 ft., and dimensions about 50x60 ft., windows were located at one side of the building only, and thus the desks located at one side of this office, at a point most remote from the windows, required artificial light practically throughout the entire working day, while desks located next to the windows were provided with suitable daylight in the early morning and toward the latter part of the afternoon.

A southern exposure, however, resulted in excessive direct rays of sunlight during the middle of the day to such an extent that heavy shades were generally pulled down, almost covering the entire window, thus not only calling for artificial light throughout almost the entire office, but actually reducing the resulting daylight at those points where it would supposedly be the best.

Here the location of the windows was the greatest factor in the excellence of daylight conditions, and the case in point only serves to illustrate how the size of windows—which in this case was entirely ample for a major portion of the room—may not be the only factor in the resultant satisfaction of the daylight conditions.

In nearly all office buildings and in many shops the desks or benches must be arranged perpendicularly with respect to the windows, as shown in Fig. 2, in order to permit the light to reach the work with the least shadows. This fact places a certain limitation upon the possible variety of arrangements of the work—a limitation which can practically be eliminated in the case of artificial lighting through a suitable location of the lamps.

This statement applies, of course, to those cases where natural light is transmitted through side windows, and refers to a feature particularly noticeable in buildings of more than one story. In shop spaces where the natural light is furnished by overhead windows, however, the work may be placed at almost any portion of the floor space irrespective of the windows, provided adequate artificial light is available.

Fig. 3. Day View of Shop, Showing Lack of Uniformity of Light Where Side Windows Only Are Used

Fig. 4. Night View of Another Location in the Same Shop. Note Uniformity of Artificial Illumination

Fig. 5. Day View of Typical Shop, Showing Effect of Overhead and High Side Windows.

Shop Windows

In addition to the size and location of shop windows, the nature of the glass has an appreciable effect on the resulting light. Considerable discussion has been indulged in to bring out the relative advantages of opaque and clear glass for shop windows, but any item related to the shop as in this case, must be approached from a liberal viewpoint.

There is undoubtedly some reduction in the light transmitted through ordinary opaque wire-glass windows, but the reduced fire risk in those cases where the shop is located close to other buildings will often determine whether or not to make use of the so called opaque wire-glass, which in such a case is, of course, a protective feature. The fact that wire-glass is also used with steel window frames is an added advantage as far as fire protection is concerned.

It is interesting to note that while opaque wire-glass reduces the amount of light transmitted into the shop space in some measure, the roughness of the outside surface of such glass will often cause accumulations of dust and dirt, which in themselves are more to blame for such a reduction than the opaque nature of the glass itself. Frequent cleaning will be a remedy.

Wire-glass windows for the roof, or ordinary skylights, is an absolute necessity in most cases, due to the protection afforded against falling objects, and the reduction of the decided glare which results from the bright sunlight shining directly through clear windows. It is true that wire-glass may be obtained in a clear form, but the expense ordinarily prohibits its use.

All things considered, therefore, a choice between opaque wire-glass and clear windows should be based upon the considerations just given, and judgment must be exercised in such a choice, particularly in balancing first cost against other advantages, which often more than compensate for a higher outlay at the start.

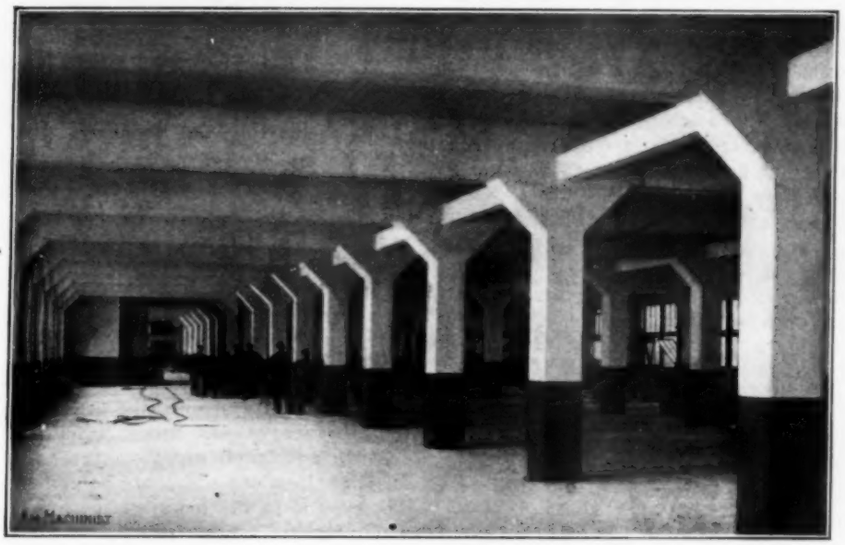


Fig. 6. Day View of Typical Shop with Side Windows Only and Relatively Low Ceiling

Fig. 7. Day View of Typical Shop with Side Windows Only and Relatively High Ceiling

Light Control

One of the prime advantages of artificial lighting compared to daylight, as before hinted, is in the matter of the control of the light, both in direction and quantity, and to a certain extent in quality. With daylight, however, control is largely governed by the location of windows in the first design of the shop building. Figs. 3 and 4 show day and night views of the same shop space, indicating the greater uniformity of the artificial light.

After the construction of the shop is completed, further control must be resorted to through the means of shades or other coverings for the windows, which, as previously stated, are apt to be unsatisfactory. A shade over a window, while it may temper the quantity of light for those in the space immediately adjoining the window, will likely interfere with the work of others located at some distance, by too great a reduction of the light.

In one shop deposits of dirt and soot on the overhead windows were such as to greatly reduce the effective light in the working space. Upon cleaning these windows in the early summer, the excessive volume of direct sunlight shining directly upon the workmen was such as to be disagreeable and almost intolerable.

In this particular instance a small deposit of dust on the glass served to modify the harsh rays of light during the summer, and in the winter the cleaning was effected to more advantage. It is often impossible to control the daylight conditions from windows already installed, to the uniform satisfaction of all unless, perchance, by some such indirect scheme as just described, although frequent cleaning should naturally be given preference at all times.

Maintenance Problems

In the study of artificial shop lighting it has been shown that one of the largest items connected with operation is the regular upkeep. The deterioration of lamps and reflectors, both glass and metal, is very rapid due to dust and dirt accumulations, and this same effect is very noticeable in connection with glass windows. Regular and systematic cleaning is, therefore, a matter of first importance in shop maintenance, and various methods have been employed for conducting this work.

In one shop, for example, a diluted solution of oxalic acid is used for scrubbing the overhead windows at intervals of two months, after which they are rinsed with clear water to wash away the accumulations. In other cases, the side windows are scrubbed with soap and water at relatively short intervals, thus maintaining the daylight conditions to a point of excellence in the interior of the shop.

The outlay for cleaning will far more than pay for itself in the increased production made possible by the better average daylight conditions, the added cheerfulness, and the reduced cost for artificial light. The most important point in work of this kind, as well as in the case of artificial lighting, will probably be apparent; namely, that all maintenance work should be systematic and regular in order to be most effective in securing the results the equipment is supposed to furnish.

Characteristics of Natural Light

There is undoubtedly much to be said in favor of the use of natural light wherever available, particularly in view of the fact, as previously stated, that daylight is a natural condition of vision. This is further emphasized by the tendency to use natural light as a standard upon which to base the value of various qualities of artificial light. The statement, "Better than daylight," as used at the outset, must be interpreted from several standpoints in order to get the true meaning of such a phrase, and it is believed in general that such a statement, if at all applicable to artificial light, is mainly so on account of uniformity and the ability to control it with ease.

Other characteristics of natural light make it practically ideal, as in the matter of diffusion, which is such as to adapt it to the eye, and which also enables the eye to endure much higher intensities of daylight than of artificial light. The proper combinations of basic colors make the resultant color of natural light unusually well adapted to practically all classes of shop work.

There is also a noticeably large range of the intensities of natural light, up to hundreds of foot-candles, which, however, are not objectionable during the day on account of the condition of the eye under the stimulus of daylight intensities; whereas at night satisfactory intensities of artificial light rarely exceed from five to ten foot-candles.

Furthermore, the redirection of light through windows, or by means of specially located openings in the building construction, is neither as practicable nor as necessary as with artificial light. Where energy costs are a vital feature, in the case of electric lamps, for example, it is essential to secure the maximum amount of light for a given expenditure of energy, while the available volumes of daylight are practically unlimited in most geographical locations.

Cost Factors of Natural Light

It is apparent that natural light has a definite value, both in initial investment and in the matter of maintenance. The first cost is dependent, of course, on the size and type of windows and of the window construction, amounting on the average to from 40 to 60c. per square foot of window space in the modern shop. This increase in first cost over and above the cost which would result by the omission of windows, or at least a partial absence of them, means an increase in the interest and depreciation value of the building, which is chargeable to the so-called cost of natural light.

In like manner the maintenance cost, consisting of the replacement of broken windows, the washing and cleaning of the glass surfaces, repairs to the window sashes, and the like, are items which continue throughout the service of the building and are also chargeable to natural lighting costs.

The total cost, however, made up of the interest and depreciation on first cost of windows, together with the maintenance, is very low in comparison to the many advantages derived, a feature which has been thoroughly studied in the relations of artificial light to shop efficiency. These facts, while seemingly commonplace, are of great importance in securing the best results.

Economic Relations to Work

Through the study of the relations of artificial light to shop work it has been proved that adequate light saves time, prevents mistakes, reduces delays in handling material and in the general routine of shop operations, adds to the cheerfulness of factory locations, makes the supervision of workmen easier than otherwise, and in a great variety of ways contributes, both directly and indirectly, to the gross economy.

In like manner natural light of sufficient quantity produces an equally important effect. Those who observe the varieties of shop construction and conditions will realize at once the great contrast between those shops which are cheerful and bright and those other less fortunate locations which are perpetually gloomy, and in which work is performed with difficulty. These facts warrant considerable emphasis on the advantages just given.

It is also interesting to note that a scarcity of windows produces a reduction in the value of that portion of the floor poorly lighted, by making it practically impossible to utilize the dark corners. Sufficient windows make such spaces available for working purposes, thus preventing losses, and more than offsetting the first cost of the additional windows.

Shop Spaces and Natural Lighting

Well provided with overhead and side windows. The average shop space provided, as in Fig. 5, will be found to afford excellent facilities for average working processes; the men will be cheerful other things being equal; and the general atmosphere of such a shop section is undoubtedly far superior to one not thus provided.

Fig. 8. Day View with Poor Natural Light

Fig. 9. Improvement Effected by Artificial Illumination

Side windows only. Such factory spaces as shown in Fig. 6, usually found where there is more than one story, will, in the case of wide aisles appear bright near the windows, but a major portion of the floor space is apt to be gloomy, even in the brightest daylight. This last statement should, however, be modified to include those factory spaces over which a very low ceiling exists. With the higher ceilings, as shown in Fig. 7, side windows provide a proportionately greater light at these points more remote from the walls.

No daylight. Some shop sections, as shown in Fig. 8, are to be found in which, practically speaking, there is no daylight whatever through the entire working day. It goes without saying that such a condition is a serious handicap, both to workmen and foremen, and unless provided with a superior artificial lighting system, it results in a low value of such manufacturing spaces. Fig. 9 shows how the problem of inadequate natural light was solved by an efficient system of artificial light.

Attention is again drawn in passing to the part played by artificial light. While greatest in those locations not provided with sufficient daylight, it is nevertheless essential as an aid in keeping the average intensities up to adequate values in both the day and night hours. The study of artificial lighting costs has proved beyond a doubt that an investment, not only for meager, but for entirely sufficient artificial light, is exceedingly small in comparison to the losses in both time and production in those shops not provided with an ample supply.

This is one of the greatest and most important arguments in favor of sufficient light, and, in fact, so important has it become, that factory managers and owners have come to a new point of view in the consideration of shop construction and location.

A Work-Holding Device used for Boring Boiler Section

The illustrations show the very interesting work-holding device, used in connection with the six-spindle boring machine, illustrated in Vol. 36, page 521. This was designed especially for boring and reaming cast-iron boiler sections at the shop of the Putnam Foundry Co., Putnam, Conn. This company makes heating boilers in a variety of sizes.

A general idea of the holding device, which consists of a box-like frame about seven feet high, and mounted on substantial rollers or wheels at each end can be obtained from Fig. 1. These wheels travel on a well-aligned track, so as to bring the work-holder between the two ends of the boring machine with three spindles available for work on each side. In the central position the track is practically a part of the machine, being supported by the foundation, so as to secure accurate alignment whenever the work is in position to be bored or reamed.

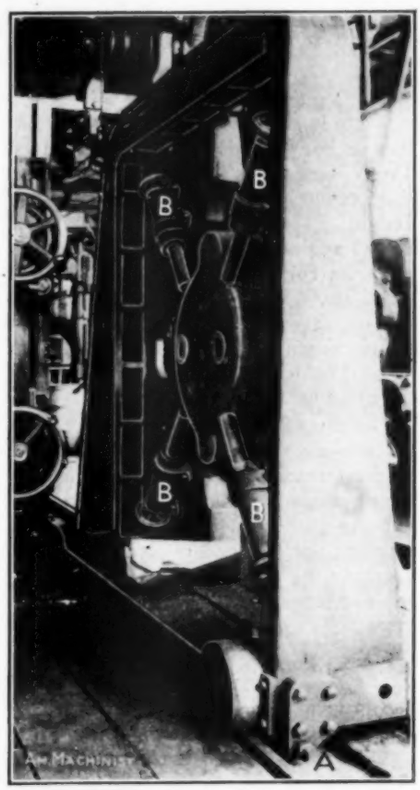


FIG. 1. WORK-HOLDING FRAME

The heavy setscrew and locknut *A* at the lower corner of the frame is a positive stop for locating the work in its proper position with relation to the boring spindles. A substantial stop is located on the bed of the machine between the two uprights, so that the frame is accurately and rigidly locked in position for the work to be done.

In the case shown one of the round sections is being bored and reamed, the manner of holding being clearly shown. There are four adjusting screws *B*, and these, together with the four draw-in bolts, shown on the front of the work-holder in Fig. 2, both hold and locate the work accurately while it is being operated on.

Several details of the boring machine can be seen in Figs. 2 and 3, and also the location of the positive stop between the uprights at *C*.

There are two of these work frames, so that one can be loaded, while the other is in place with the work being operated on; this makes it possible to run the boring machine almost continually. These work frames are handled by power, as can be seen from the overhead drum in Fig. 1. A small wire rope running around suitable pulleys handles them very easily and quickly.

The design of the work-holder, as well as the specifications for the boring machine, are by the superintendent of the Putnam Foundry Co.

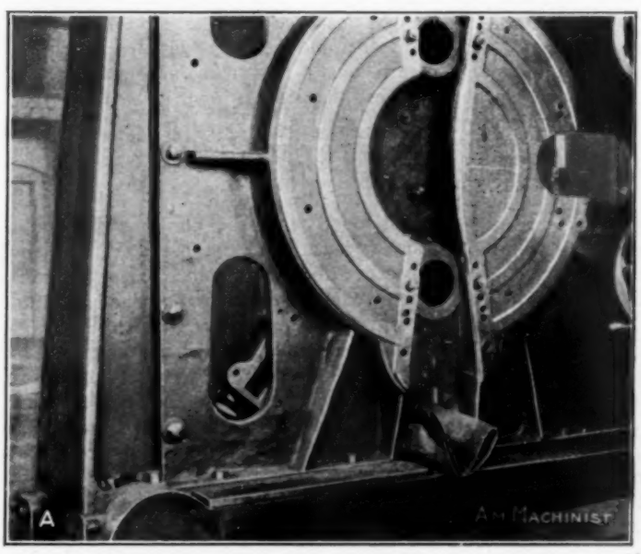


FIG. 2

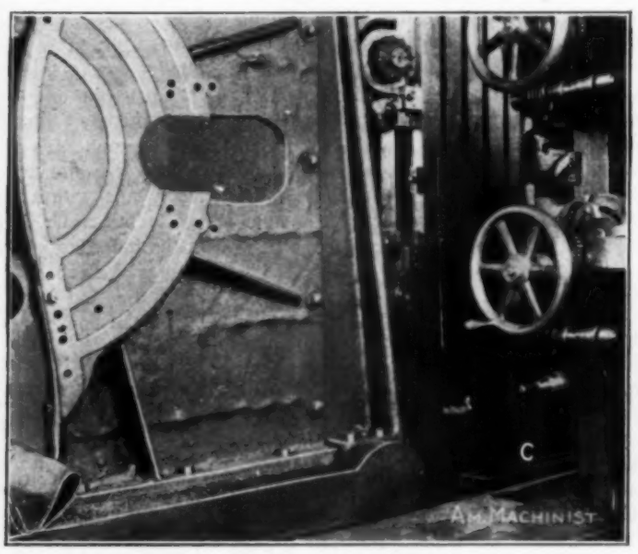


FIG. 3

DETAILS OF LOCATING STOPS AND WORK HOLDER

Everyday Screw Thread Troubles

By F. G. Coburn*

A consideration of the troubles which have come up in securing satisfactory results with the fitting of threaded parts, and suggestions for remedying the defects.

*Asst. Naval Constructor, U. S. Navy.

While many are familiar with the points here brought out, thousands of dollars are still wasted, vexatious confusions and delays are still caused by the non-standardization and the consequent lack of interchangeability of screw threads. A great deal of work has been done on the subject, as a result of which a large part of our trouble is immediately eradicable.

Usually tap and die, and screw and bolt troubles are laid up against the quality of material or workmanship of the offending articles. Of course, there are lots of poor thread-cutting tools, and carelessly made screws, bolts and nuts on the market, and some of the trouble may properly be laid to this cause. But this part of the trouble is, in reality, small as compared to the whole.

The Tap

Suppose we consider first the tap. The much maligned tap is liable to a good many faults besides quality of material and workmanship. Of course, if the steel is too soft it will not take the

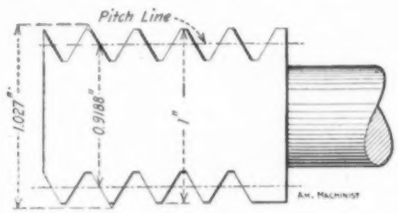


Fig. 1. One-inch U. S. Standard Thread

right temper; if too hard it will be too brittle; or if of the right metal it may not be tempered properly. The tap may be crooked, "out of wind," but mounting it on centers discloses the fault at once. Or the sides of the thread may be rough, making the tap bind; but this is at once apparent on examination with the pocket glass. These are all matters determinable by a superficial examination, requiring no special apparatus or investigation; and as such taps do not usually get by the inspection in any shop, only a small proportion of the trouble can be ascribed to these deficiencies.

General Dimensions

Until about three years ago, we had trouble because of the lack of uniformity in general dimensions; but then the tap and die makers got together and standardized lengths, shank diameters, shank-square dimensions, number of flutes, and threaded lengths for all sizes of all taps, such as hand taps, tapper taps, pulley taps, etc. Except when old-time goods are encountered, these difficulties are no more.

U. S. Standard Thread

There is still more or less misinformation as to what the standard thread is. The V-thread was once very common in this country; its basic formula was: Height of thread $= 0.866 \times$ pitch. The thread was never satisfactory, as it weakened the bolt, and the taps did not wear well, etc. Finally the U. S. standard thread advocated by the Franklin Institute began to be adopted for general use. The basic formula of the thread is: Height $= 0.6495 \times$ pitch.

The thread is flattened top and bottom for one-eighth the pitch, and the angle of the thread is 60 deg. This is a good strong thread, cutting tools wear well, and the pitches adopted as a part of the standard serve all general uses admirably. To make the description complete, I give these pitches, for the following diameters:

Diam.	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
Pitch	20	18	16	14	13	12	11	10	9	8	7	6	5	4½

These are U. S. standard, for the thread of the basic 0.6495 formula. It is not superfluous to dwell on this; I heard a tap maker say recently that his house had received an order for some half-inch U. S. standard V-thread, 12-pitch taps. What did the man want?

In addition to these there are finer pitches for brass taps, for the automobile industry, and others, all based on this standard basic formula. All requirements can be met.

Now it is not uncommon for a man to tap a hole with a V-thread tap and then try to put a U. S. standard thread bolt in the hole. He immediately is in trouble, blames the tap or bolt or both, gets the right die and runs down the bolt, and hopes the house will buy him good bolts thereafter.

This trouble may be avoided by sticking to the U. S. standard thread for taps, dies, bolts and nuts. It is rather astonishing indeed, that this should need mentioning, for after all that has been said about the U. S. standard thread, the machine shops are still using the V-thread practically as much as the U. S. standard.

This was recently estimated by an analysis of the sales of leading tap makers, and substantiated by an analysis of the demand for capscrew and setscrew. As the bolt and nut makers are putting the U. S. thread on practically all of their output, it is not difficult to see where a large part of the shop trouble with bolts and nuts comes from.

The included angle of the thread may not be correct. With a correctly made gage, this error, if large, may easily be determined. If the error is small it is not so easy to determine; but fortunately if everything else is tolerably right the troubles arising from the error are not serious.

Outside and Root Diameters

The tap may be oversize on the outside diameter. But there is a maximum limit to this oversize. Fig. 1 shows a 1-in. U. S. standard tap. If the sides of the thread (included angle 60 deg.) be pro-

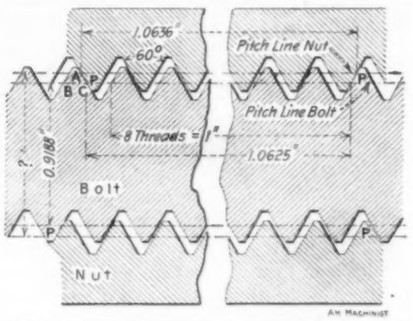


Fig. 2. Nut Tapped by 1-in. Standard Tap

duced clear out to the intersection, the increase in the outside diameter is only 0.027 in. and as the pitch diameter is not affected, no particular harm is done. Actually, a little oversize is necessary, say 0.002 in. for any size, in order to give clearance for the top of the bolt thread; and as it is not practicable to turn out a tap with absolutely sharp edges, the trouble on this score is not at all serious.

The tap may be undersize on the root diameter. This results in a loss of clearance for the bottom of the bolt thread, and must be looked out for. It should be at least 0.002 in. oversize, as compared with the theoretical size, in order to produce this clearance, and a little more is allowable, say 0.001 to 0.003 in. perhaps, depending on the size of the tap; this oversize simply results in a slight decrease of the bearing surface, which can be tolerated. No undersize of root diameter should be tolerated, however.

Pitch Diameter

We now approach one of the real big troubles, that of variation in *pitch line diameter*. This is the figure that counts,

because it is on the pitch line, or rather, the angle of the thread, that the bearing comes. Obviously no undersize should be tolerated, as undersize will result in a hole too small for the normal bolt. And an oversize of 0.001 in. should be demanded, to allow for wear.

If the tap is too much oversize, a loose fit results, which is extremely undesirable in many classes of work. So there must be a limit; but the problem as to what that limit ought to be is a great big one, to be settled only after long investigation by engineers, tap makers, and tap-and-bolt users. As an approximation, for ordinary uses, limits of 0.003 to 0.005 in. might be observed, depending on the class of work and the size of tap. If each user will look into the subject, see how involved it is, and set temporary usable limits, he will profit by it, as he will be greatly helped in selecting taps.

Error in Pitch

The tap may not be of exact pitch. That is, a ½-in. tap may be nominally 13 threads per inch, not 12, and still be out, say, one or two thousandths of an inch in pitch per inch. A little error in pitch makes a big difference. It makes no difference whether the error be over or under, the effect is the same as that of error in pitch-line diameter. See Fig. 2.

This figure illustrates a nut tapped by a 1-in., 8-pitch U. S. standard tap having an error of 0.001 in. (plus) in lead, spun on a 1-in., 8-pitch U. S. standard bolt of exact size. Suppose that the tap is sufficiently oversize to admit the perfect bolt one inch into the nut; there will be two, and only two, bearing surfaces. This is obvious. These surfaces are indicated in the section by the points *P*. The distance between these bearing surfaces, measured on the *pitch line* of the *bolt* is (one inch plus ½ pitch) 1.0625 in. And so the distance between bearing surfaces measured on the pitch line of the *nut* is (1.0625 in. plus 0.001 × 1.0625 in.) 1.0636 in.

The side *BC* of the little 30-deg. triangle is equal to half the difference between 1.0636 and 1.0625 in., or 0.00053 in., and thus the side *AB* is equal to 0.00053 in. × $1\sqrt{3}$, or 0.00092 in., so that the pitch-line diameter of the nut must be 2 × 0.00092 in., or 0.0018 in. large. This is equivalent to saying that if a 1-in. tap has an error in pitch of 0.001 in. per inch, it must be 0.0018 in. oversize in pitch diameter, if a *perfect* screw is to work freely in it.

What should be the oversize if the bolt is 0.001 in. per inch (minus) out in pitch, and 0.002 in. undersize in pitch diameter? It is plain that the question of settling on limits of the pitch diameter of taps is a big one. Or suppose that the thread on the bolt is die-cut; as the helical angle is greater at the root of the thread than at the top, and as the top of the bolt thread is cut by the part of the die thread which is correctly formed to cut the bottom of the bolt thread, the shape of the thread is incorrect, and we have some more trouble.

First Aid

The close interconnection of limits for pitch diameter oversize and error in pitch, is obvious. The problem is further complicated by the practical questions of tap manufacture; and so the best the ultimate consumer can do is to agitate for standardization. The question may be asked: "What shall we do in the meantime?" We have discussed the troubles fully, but have suggested no relief.

Appliances for measuring error in pitch are rather costly, and can be afforded by large houses only. But thread micrometers for measuring the pitch diameter are not so very expensive; and if used in buying taps will pay for themselves. Disregard the error in pitch, and allow for possible error in it by increasing the oversize in the pitch diameter. Find out by trial how much pitch diameter oversize your work will allow, and use that for a maximum, setting 0.001 in. as the minimum oversize limit. This will afford considerable relief; and if bolts are inspected to see that they are nothing oversize (preferably 0.001 or 0.002 in. undersize) and not more than 0.005 in. undersize—for average requirements—a very large percentage of the wastes and delays in the average shop will be eliminated.

Machine Screws, Taps and Dies

Troubles with machine screws and machine-screw taps and dies have all been settled by the American Society of Mechanical Engineers and the Tap and Die Manufacturers' Association. Back in 1902 that society appointed a committee to propose a standard for these goods, and in 1907, after five years' study and collaboration with tap and die makers, a report was made, embodying what is known as the A. S. M. E. standard. It is indorsed and adopted by the tap and die, and screw makers, and is a great work. If all users of these goods would order to this standard, there would be no more trouble arising from their use.

This standard is a great boon to houses buying on specifications. It makes no difference who makes the goods, they are bound to be interchangeable. The largest allowable screw will go into the hole tapped by the smallest allowable tap; error in lead is taken care of in pitch diameter tolerances, and all limits are specified absolutely. About three years ago a movement was started which resulted in the adoption by the Navy Department of this standard, and it is expected that that department will soon realize great benefits from the step.

Of course, the change cannot be made abruptly. In one plant it was found that for years employees had referred to the No. 20 machine screw as a $\frac{4}{64}$-in. machine screw, because it is about $\frac{4}{64}$ in. in diameter, *caliper* measure. So they tapped for it with a $\frac{4}{64}$-in. hand tap, and when the screw would not go in the hole they blamed the tap. The screw has 20 threads per inch, the tap 18. Even after that plant formally adopted the A. S. M. E. standard, it went on for a couple of years running down the No. 20 screws with a $\frac{4}{64}$-in. die before using them.

Some Rules

This discussion may be summarized into some rules, which may be of assistance to the practical man.

Use only U. S. standard thread and pitch; remember the 0.6495 formula.

Buy some thread micrometers; see that taps are at least 0.001 in. oversize, never (usually) over 0.005 in. oversize; see that bolts are at least 0.002 in. undersize, not more than 0.005 in. undersize; see that nuts work freely.

See that taps are at least 0.002 in. oversize on the outside diameter; do not worry if they are more oversize. See that they are nothing undersize, preferably at least 0.001 in. oversize, on the root diameter.

Get acquainted with the A. S. M. E. standard for machine screws, machine-screw taps and dies, and buy to these specifications.

Agitate for standardization of limits for hand and machine taps and dies, and for bolts and nuts.

In cost keeping there can be very little quarrel as to how to apply material in article costs. Reports of weighed and measured quantities are always chargeable directly to an order or article. The difficulty in devising methods to make sure that a correct report is made of all material used, is of two natures, physical and human. While it is true that the introduction of proper methods of receiving, storing, and issuing raw materials, and taking care of finished and semi-finished parts, demands an outlay of money in storerooms, clerical attendance, etc., it can be safely stated that such equipment invariably returns full value, in a reasonable time, in the savings made through minimum investment in supply of material to satisfy the demands of manufacture because of certainty of knowledge of supply on hand, promptness of delivery, and saving of waste. From the viewpoint of getting proper reports of material for costs, of course, such an equipment is invaluable in its assistance toward accuracy. It will largely solve the physical difficulty of gathering costs of material since it readily permits a definite record of its movements.—*Engineering Magazine.*

Pointers on Improved Design

By George W. Meyncke

Examples of poor design on standard and special machinery that careful analysis on the part of the designer would have eliminated.

The following are a few improvements that have been made on standard and special machinery, built by some of our leading machine builders. They show a right and wrong way, and raise the question: "Could not these weak points have been determined when designing, by careful analysis on the part of the designer?"

The racks in Fig. 1 were reciprocated by the pinion *A*, driven through the miter gears by the segment *B*. The miter gears wore out quickly and the bearing required frequent rebushing. The additional bearing *C*, Fig. 2, was added, and the machine has been running for over a year without any repair, while the gears show no signs of wear, and the machine gives greater satisfaction because of smoother running racks.

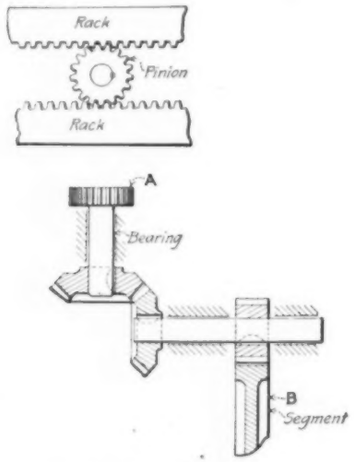


FIG. 1. THE OLD DESIGN

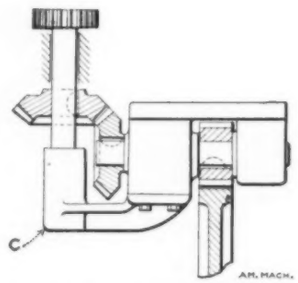


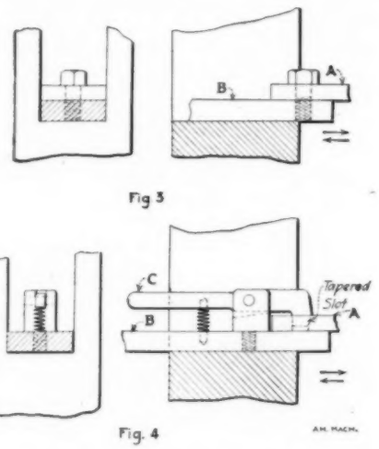
FIG. 2. THE IMPROVED DESIGN

In Fig. 3, slide *A* was connected to *B* by the capscrew, as shown. This slide required frequent disconnecting; this wore out the thread in the slide, the patience of the operator and also took valuable time. The lever *C*, shown in Fig. 4, is held in a tapered slot by a spring, which allows rapid disconnecting.

The details in Figs. 5 and 6 explain themselves. The contact of the lever against the cam was, of course, subject to excessive wear and was replaced with a roller. Fig. 7 shows another correction that saves repairs. The pinion *A* reciprocates the racks *B* and *C*, which were exposed to dust from paper slitters and wore out frequently; and as the racks were phosphor bronze, replacing them was found expensive. The amount of space over the rack being limited, the sliding covers were made, and at half the cost of new racks.

The racks and pinion show no signs of wear after over a year's run with the covers. The sheet-iron cover *D* covers the pinion *A*. The sheet-iron strips *F* and *H* are fastened to the racks and extend out over the teeth. Felt is fastened to the cover *D*, as shown, which wipes off all dirt from the rack covers as they pass under it, thus keeping the dust out of the rack teeth and off the pinion *A*.

An example of the right uses of springs is shown in Figs. 8 and 9. The flat springs *A*, Fig. 8, broke at the first screw after comparatively little service, and were replaced by coil springs, as shown in Fig. 9. The bunter block *A*, Fig. 10, is subject to a downward pressure, and had to be



EFFICIENT LEVER APPLICATION

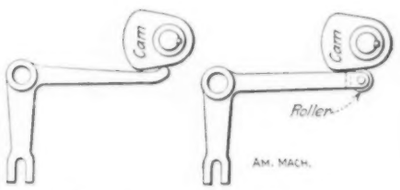


FIG. 5 FIG. 6
AVOIDING CAM WEAR

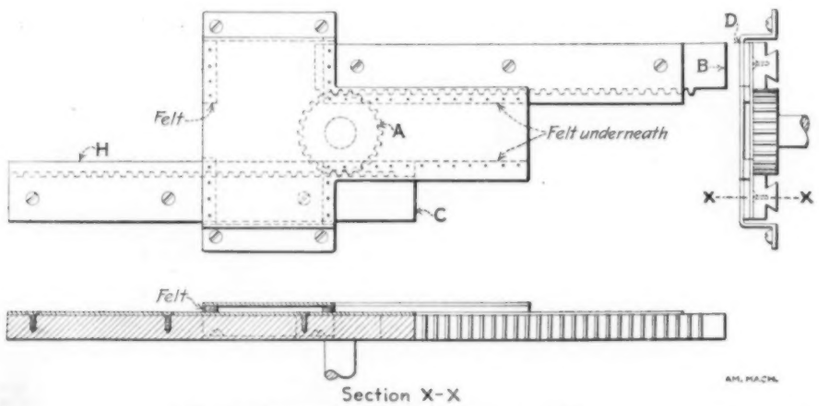
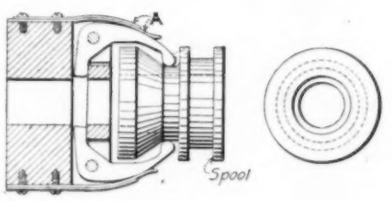
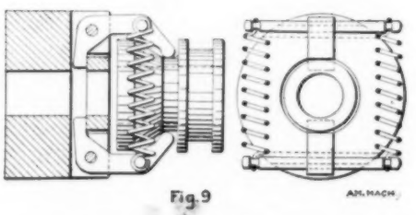


FIG. 7. PROTECTIVE COVERS TO SAVE WEAR





APPLICATION OF COIL SPRINGS

withdrawn to the left to adjust or change tools. The clamp was altered as in Fig. 11; a few turns of the clamp screw frees the clamp, and the bunter block to be milled from under the die (not shown).

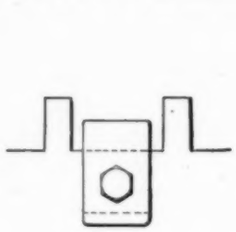
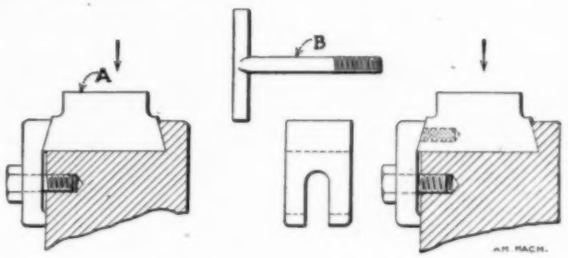


FIG. 10



AN IMPROVED CLAMP DESIGN

FIG. 11

Grinding Eccentric, Semi-cylindrical Bushings

BY PETER STEINER

The semicylindrical eccentric bushings shown in Fig. 1, were required to be made of tool steel hardened and then ground all over, excepting the ends, to within very close limits.

This is accomplished as follows: In the first place a cast-iron block, Fig. 2, was planed and finished very accurately respecting the sides, being square with each other, and all opposite sides were made parallel, although this is not absolutely necessary. The block was then mounted on the faceplate of a lathe so that the center on the broad side of the block coincided with the lathe center; this, of course, only had to be approximate.

A parallel was then fastened on the faceplate with the edge *A* of the block, tissue paper being inserted between the edges to determine whether the edges really were in contact. Next a hole was bored through the block, which was then shifted along on the edge of the parallel a distance equal to the eccentricity of the bushings, care being taken to pinch the paper in reclamping.

The hole was then rebored, tapering, to within ¼ in. of going clear through. Thus the holes produced were exactly in line.

I then rough-turned and bored the piece shown in Fig. 3, and also planed the slot with allowance for grinding at *C*.

It will be noticed that the bottom of the slot *A* is in the same plane as the centers of the two holes. The piece was then chucked in the grinder and the hole *B* and exterior surface *C* ground. The slot was next ground at *A*. It was ground until the distance *D* was exactly one-half the distance of *C A*. A mandrel was next fitted to the hole *B* and the projecting end was finished, tapering for the hole A^1, Fig. 2. With the mandrel in place in the hole *B*, Fig. 3, the block was placed on the other end of the mandrel, which was then placed on a surface plate with the block resting thereon. With an indicator the surfaces *A* were set exactly parallel with the surface plate or bottom of the block; the block on the end of the mandrel, of course, had to be turned or shifted to accomplish this.

Another mandrel was fitted to the grinding-head spindle and projected beyond the faceplate. The projecting end of the mandrel was made to fit the hole B^1, Fig. 2, of the block. With the mandrel in place the block, with the assembled pieces on it, was strapped to the faceplate. The hole *F*, Fig. 3, was then ground in that position. Eccentric cylindrical bushings were then rough-turned and bored, and slit, with an allowance for grinding. After the bushings were slit they were hardened.

A mandrel was then made to grind the bushings on the outside. The mandrel was turned tapering on both ends to fit the hole in the block, Fig. 2. With the block on the surface plate and the mandrel in it, a line was drawn with the surface gage central on the length of the mandrel and on the face of the block. The block was mounted on the faceplate of the lathe as already described and the one end of the mandrel centered, and turned end for end so that the lines on the mandrel and block coincided; the other end was then centered.

In the same way a mandrel to grind the small bushings was made with the difference that a bushing for the hole in the block was made, as the mandrel was smaller than the hole in the block. The bushings were then placed on the mandrel; that is, the two parts, in the correct relative position governed by the line on the mandrel and place of saw cut in the bushing, and were then soldered together and ground in that way. They were then surface ground and lapped at *B* to the required dimension.

The two halves of the two sets of bushings were then placed in the fixture as described in Figs. 3 and 4. A small clamp was clamped on the surface *A*, which projected into the hole. This clamp served to locate the bushings in the correct relative position. One edge or end of the bushing was back farther than the other by the width of the clamp. Another mandrel was then made and fitted to the grinder headstock spindle, which carried on its end the fixture at *F*, Fig. 3, for internal grinding the bushings. In the original setting the external surfaces *A*, Fig. 3, were also ground, which served as a testing surface in the subsequent setting up of the job. The hole was then in shape and position to be internal ground.

The small bushings were ground in the following way: After grinding the large bushings they were retained in the fixture, but one turned end for end, which looked then as shown in Fig. 5. It will be noticed that the diameter of the small bushings is less than the diameter of the hole in the large bushing. Another semicylindrical bushing was then added on the outside of the small bushing, which now equaled the diameter of the hole in the large bushing. The small bushing was then slipped in the fixture together with the filler bushing, as shown in Fig. 5, which was then positioned properly for grinding.

It must be noted that in this operation the fixture was running eccentric at *A* and concentric at *C*. With the block on the faceplate as already described and a mandrel fitting the tapering hole *A*, Fig. 2, and hole *F*, Fig. 3, *C* would run concentric.

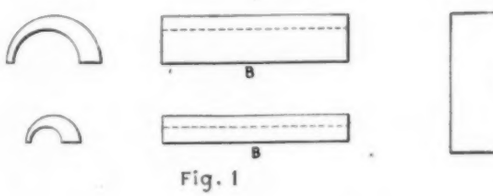


Fig. 1

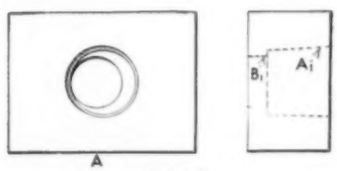


Fig. 2

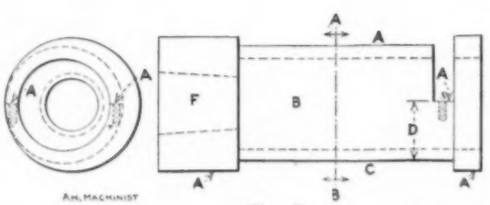


Fig. 3

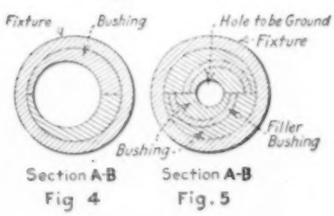


Fig 4

Fig. 5

GRINDING ECCENTRIC, SEMI-CYLINDRICAL BUSHINGS

In a Vermont Granite Working Shop

Editorial Correspondence

Method of sawing large blocks into slabs and the way a revolving disk planer works. Sharpening the disks.

Roughing off and polishing granite surfaces. Turning and polishing columns.

Most of us have a vague idea that all stone is formed or cut to shape by a man with a hammer and chisel after the stone has been blasted out of the quarry, and to most mechanics it comes as a surprise that many kinds of stone are shaped in machines closely resembling those of the ordinary metal-working shops.

Lathes, planers, surface grinders, punch presses, all are used in the large stone-working plants and the machines themselves could easily be mistaken for their brothers of the metal-working class. Not only this, but in many cases the tools used are of steel and very similar to those used on metal, especially when the softer grades of marble are being worked.

However, where the machines and tools are nearly alike, no description of them will be given in this article, and only machines or devices especially adapted to granite working, as done in the mill of Jones Bros., Barre, Vt., will be noticed. This firm handles a tremendous amount of granite and has one of the best equipped plants in the country. It must be understood that granite is one of the difficult classes of stone to work, and steel tools of the ordinary type cannot be successfully used on it.

Large granite blocks are cut into slabs with a gang saw as show in Fig. 1. The framework of this saw, which was built by the F. R. Patch Mfg. Co., is of structural iron and the saw blades are carried in a swinging frame or sash, made of two long pieces of 6-in. pipe *A* and *B*, across the ends of which two pieces of channel iron are fastened by heavy corner brackets. The saw blades may be spaced any distance apart by loosening the nuts on the anchor bolts and sliding the brackets along the channels.

The teeth of the saw blades are coarse and resemble those of an old-fashioned, crosscut log saw, though the teeth are not used to cut the granite, but simply act as carriers for sharp sand which is thrown on the granite at *C* and is washed down into the cuts by the streams of water *D*, from the pipe *E*.

Sometimes the abrasive used is a mixture of sand and chilled shot pumped or washed onto the saws. Boards are used to help direct the water and abrasive into the cuts. Teeth are cut on both edges of the saws, so that when one edge is worn down the blades may be turned over. The granite blocks rest on low trucks running on a track, so that they may be easily moved to where a crane can handle them.

Planing Large Blocks

Granite blocks of large size which have been roughed down close to size are surfaced off in what is known as a McDonald planer, though it more closely resembles a two-spindle miller of the Ingersoll type.

The planer at work on a large block is shown in Fig. 2. Each of the two vertical spindles *A* and *B* has a four-armed, cast-steel head on the lower end. Each arm carries a steel disk such as shown at *D*, *E* and *F*, or eight in all. These disks are held in bearings that may be adjusted to tilt the disk to the needed angle. As the heads carrying the disks revolve, the beveled edges of the steel disks wedge or flake off the granite, leaving a comparatively smooth surface, which is easily ground and polished.

Brushes are fastened to the heads so as to keep the loose chips from getting under the disk. The table feeds along slowly, like the table of a large miller.

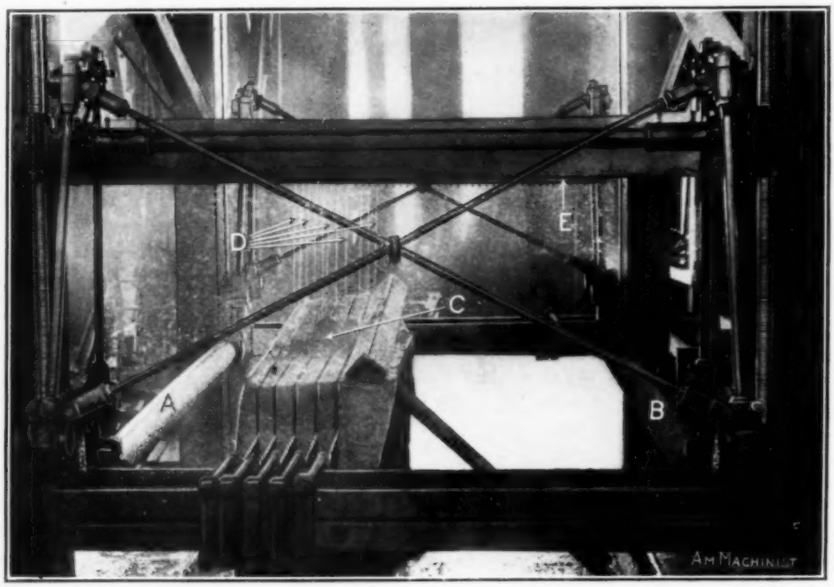


Fig. 1. Sawing Granite Blocks Into Slabs

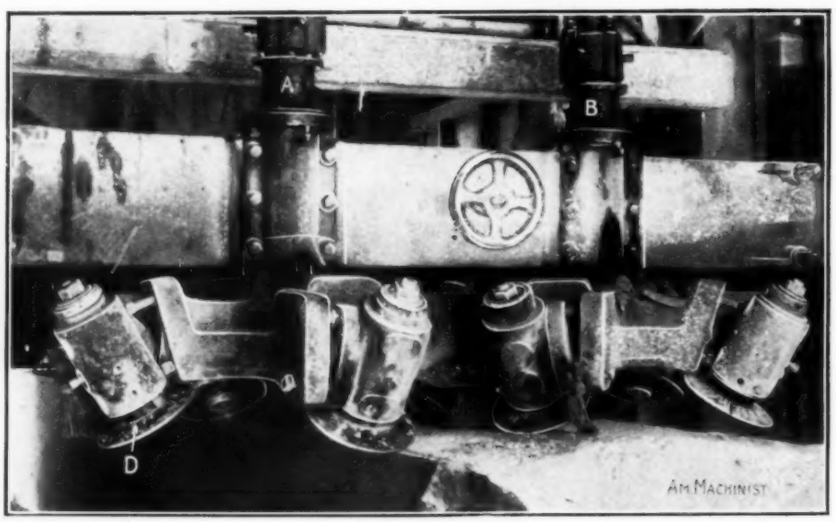


Fig. 2. Surfacing Off a Large Block of Granite

Sharpening the Disks

When the steel disks are too dull to use, they are reground on a grindstone as shown in Fig. 3. The disk *A* is placed on the end of the spindle *B*, which is run by the gear *C*, operated by a worm and the belt D. Water is supplied from the pipe *E*. The disk not only rotates, but means are provided for feeding it across the face of the grindstone in order to keep from wearing ridges in it.

From the position of the disk and grindstone, a good idea can be formed of the bevel that is ground on the edge of the disk.

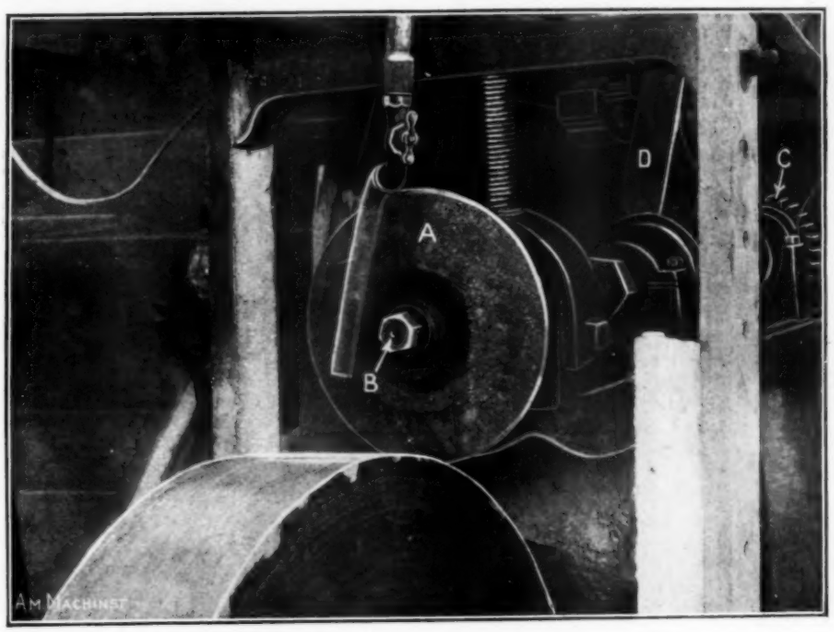


Fig. 3. Fixture Used for Sharpening Disks

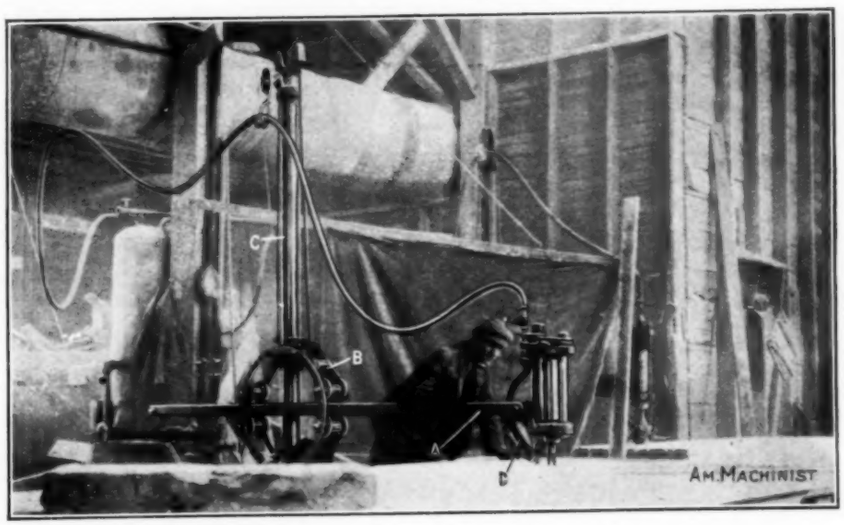


Fig. 4. Roughing Down a Surface

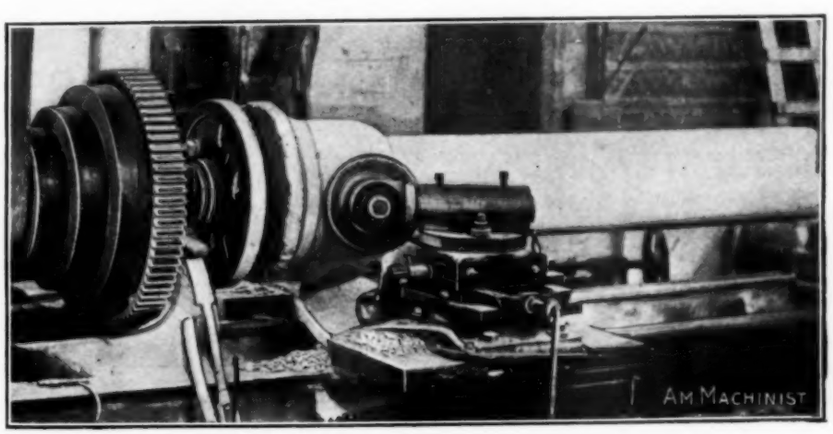


Fig. 6. Turning a Column in a Lathe

Roughing Down a Block

Blocks are roughed down to a fairly even surface with an air hammer, mounted as shown in Fig. 4. The bar *A* which holds the hammer runs through between rollers in the frame *B*. This frame is counterbalanced and is made so that it swings easily around the post *C;* it can also be placed at any desired height. With this device the operator has only to guide the chisel, without having to move any appreciable amount of weight. A blower is placed at *D* to blow the dust away from the operator and keep the chisel point free.

Polishing

Polishing or grinding down the surface of slabs, or blocks, is done in a number of ways, but one of the latest types of machines is shown in Fig. 5. The grinding or lapping device consists of a set of cast-iron rings mounted as shown, which are charged with carborundum or other abrasive, and moved over the surface by the operator, as they revolve. Abrasive of different grades is used according to the stage of the work, or the degree of finish desired.

Turning Columns

Granite columns are roughed out, centered and placed in a lathe, as shown in Fig. 6, where they are turned with a steel disk, which flakes the granite off in the same manner as on the planer already shown. A granite column is turned at about the same feed and speed, as an iron column of the same size would be.

Polishing Columns

These columns are smoothed up and polished as shown in Fig. 7. As will be seen, the column is run between centers and wooden blocks, shaped to suit, are held on top of the column as it revolves, carborundum and water being used to

Fig. 7. Polishing a Column

grind the surface smooth and even. These wooden blocks, or laps, are given sufficient lateral movement to avoid making ridges in the work.

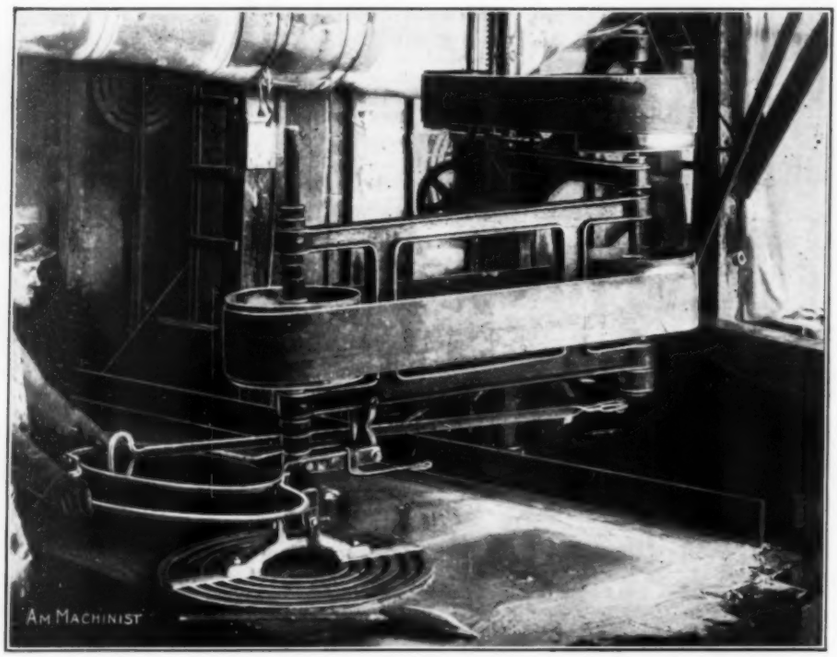


FIG. 5. POLISHING SLABS

Milling Fixture for Spiral Oil Grooves

BY WALTER BUTTS

I made a little device to mill a spiral either right or left, whichever direction the gear runs, to attach to an ordinary hand miller with lever movement. An angle bracket was made with a base to fit on top of the table in the T-slot, and fasten with one screw only. Two holes at right angles to each other were drilled for the two bevel gears, as shown in Fig. 1, at *J* and *K*.

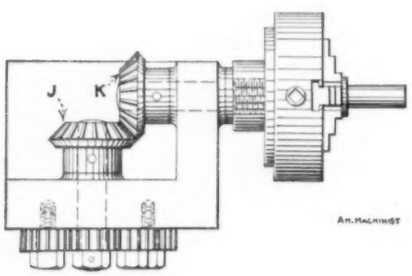


FIG. 1. PLAN

A small lathe chuck was fitted to the end of the shaft on the opposite end of the gear *K*. A spur gear *A*, Fig. 2, was fitted on the opposite end of the gear *J*. The rack *L* was fastened with two screws on the crossbar of the miller, and in line with the gears. The gear *C* was fitted in the rack. The idler *B* meshed between *A* and *C*. This movement cuts a right-hand spiral. For a left-hand spiral, remove the idler *B* and slip on the stud *E*. The idler *B* is held in place by a washer and thumb-screw, and is easily removed.

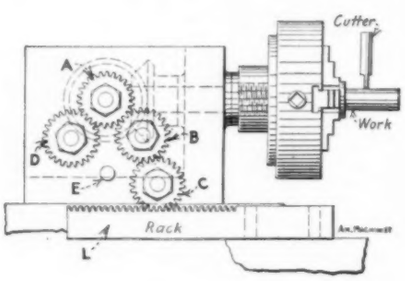


FIG. 2. ELEVATION

All four spur gears are of even dimensions and are fitted tight in mesh so as to prevent any lost motion or back lash. The whole attachment, with the stud being cut, is shown in Fig. 3. The cutter *H*, Fig. 4, is made of a piece of ¼-in. drill rod, properly backed off and hardened. I run on high speed and start the cutter from the end of the stud, as shown in Fig. 3. The result is a clean and smooth oil groove through the full length of the stud.

By setting the miller head on a slight angle, I cut clean up to a shoulder on the stud; then I drill the oil hole to suit the oil groove. By cutting the oil groove out on the end of the stud, there is no clogging up. It took me just 2½ min. to cut a stud 3 in. long.

In our department we have all blueprints for these properly marked and showing oil grooves either right or left hand, and mill in the slots before taking them to the storeroom. This applies only to the studs to be riveted, as on a screw stud there is a chance of not getting the oil groove in the right place. It does not take more than 10 min. to mount or dismount this attachment on the miller.

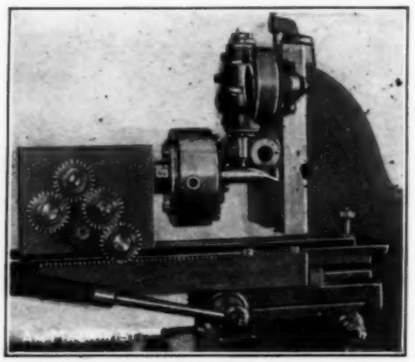


FIG. 3. THE COMPLETE ATTACHMENT

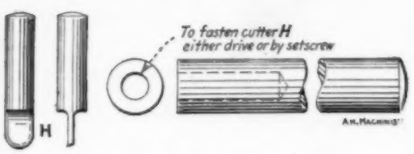
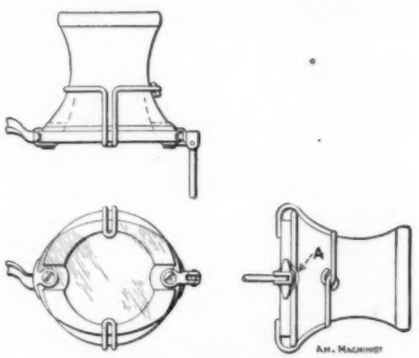


FIG. 4. CUTTER AND SOCKET

Loupe Device for Eyeglasses

BY WILLIAM J. GOURLEY

The cut shows a little device I have for holding my loupe on my eyeglass. It is easily made of very light spring wire, say 0.020 in. in diameter, etc. The flange of the loupe is filed at *A* to allow it to slip past the temple-fastener on the glass.



LOUPE DEVICE FOR EYEGLASSES

In use the loupe is slid on the glass from the temple toward the nose, and after a few trials is a quicker and easier method than any I know of.

When doing riveting and no rivet set is available, a cupped-point setscrew will make a very good substitute.

Two Turret Lathe Instruction Cards

By H. W. Reed

Two instruction cards, based on elementary time study under the Taylor system and applying to two pieces made on a 1½x18-in. turret lathe. Detailed drawings of the pieces, a tool setup, and the tool lists are given.

I realize that there is a considerable risk, in writing of any single element of scientific management, of the reader losing sight of the fact that its greatest value lies in its connection with the system as a whole; and that separately its value is greatly diminished, and its use likely to be harmful rather than beneficial.

Time study is but a part of the Taylor system, and the time saved is not accomplished by any miraculous means, but by common-sense methods of preparation before the work enters the shop; and holding everyone to these methods until its completion.

Standardizing Conditions

Time study such as that upon which the illustrations for this article are based, would be practically useless unless conditions had been standardized. By that is meant that the operator must be assured of having all tools required delivered to him. These tools must be in first-class condition, just as they were when the elementary time study covering their use was taken. For example:

We cannot expect an operator to perform the work indicated on the instruction card in the time allowed if he has to spend time hunting for tools that should be delivered to his machine; or if his machine is not in first-class condition. Neither can we expect this if the tools are in such condition that they cannot be handled without delays, such as would be encountered if the tools to be placed in the turret head did not fit properly; or if the operator has an insufficient number of cutting tools for his needs.

Furthermore, owing to the oil used on a machine of this type, the inspection of the belts is an important factor in arriving at and keeping the time standard; therefore, to avoid slippage, the belts must be frequently cleaned, and the tension checked. These details are typical of many that must be taken care of before any workman is asked to follow a fixed schedule or instruction card for the job.

The time given for the jobs used as illustrations is based on the conditions existing in one particular shop; this time would, therefore, be correct for any shop operating under similar conditions. In a few shops, the time might be in excess of that required under more highly perfected conditions and in many other shops it might be entirely too low, owing to the fact that conditions had not been standardized. Time study, taken under standardized conditions in one shop, is applicable in another shop only when conditions have been similarly standardized.

DM 11
INSTRUCTION CARD FOR OPERATION

Symbol
1 *MV* 1¼ *VZ* 2 *B*.

1 Sheets, Sheet No. 1		Drawing No. 7747	Machine No. L 26	Order No. *MV* 1¼ *V*
Material	Class No.	Pieces in lot	Time for lot	Bonus

Description of operation
TURN, CENTER, FORM AND CUT-OFF.

Item	Detailed instructions	Feed	Speed	Element time per piece	Time for entire lot	Continuous on running time
1	Change time card				2.00	
2	Study instruction card and drawing				6.00	
3	Put 1¼ jaws in spindle				0.80	
4	Put stock in machine, adjust collets				0.80	
5	Set stop for stock in port No. 1				0.39	
6	Put turning head on turret in port No. 2				0.42	
7	Put in turning tool and set to turn to 1.245 diam.				6.00	
8	Set stop for turning tool				0.43	
9	Assemble *DSLP* No. 2—*CCC H* ¼ and *D XS* in port No .3				0.66	
10	Put *CC HD* in port No. 4				0.21	
11	Put *DSG U* No. 2 in front of cross-slide				2.10	
12	Put *PATF* No. 667 in *DSG U* and clamp				0.75	
13	Set stop for *PATF* tool				1.10	
14	Put *PATL* tool in back of cross-slide and set				0.77	
15	Change speed and feed				0.40	
16						
17					22.83	
18	Turn turret			0.06		
19	Set stock to stop			0.15		
20	Turn turret			0.06		
21	Turn body of piece to 1.245 diam. 2.1 run	0.007 *A*	336 *3BF*	1.13		
22	Stop mach. gage and measure			0.36		
23	Turn turret and start machine			0.10		
24	Center end	*HF*	*3BF*	0.25		
25	Turn turret			0.06		
26	Set *CC HD* in center of piece			0.03		
27	Form with *PATF* tool	*HF*	*3BF*	2.10		
28	Move *PATL* tool to work			0.03		
29	Cut piece off	*HF*	*3BF*	0.37		
30	Put pc. in tote box			0.06		
31				4.76		
32	60 per cent on handling time 0.91			0.55		
33	10 per cent on machine time 3.85			0.39		
34				5.60		
35	Disassemble machine 4.00					
36	Time for lot = (No. pcs. × 5.60) + 4.00 + 22.83					
37						
38	Time for 50 pieces = 306.83 or 5.1 hours					
When machine cannot be run as ordered machine boss must at once report to man who signed this card		6 Month	8 Day	10 Year	Signed R. Checked H.	

TABLE 1. TURRET LATHE INSTRUCTION CARD FOR PIECE SHOWN IN FIG. 1

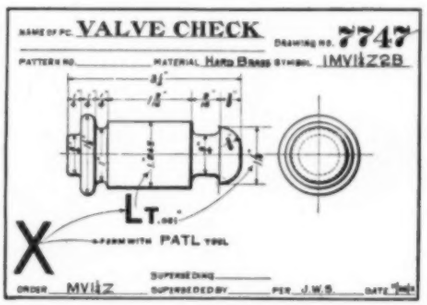


FIG. 1. DRAWING OF PART CORRESPONDING TO INSTRUCTION CARD TABLE 1

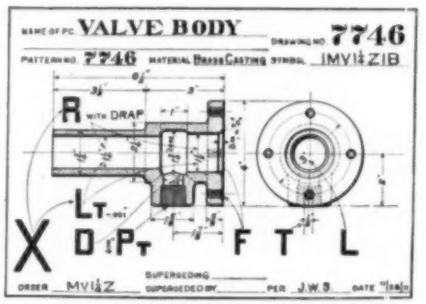


FIG. 2. DRAWING OF PART CORRESPONDING TO INSTRUCTION CARD TABLE 2

Instruction Cards for a Turret Lathe

In submitting the two instruction cards for work done on a 1½x18-in. turret lathe, one for bar work and another for chuck work have been selected. The two cards, while based on the same laws that govern all time studies, show different means of conveying to the operator the method of setting up the machine preparatory to the actual work of production.

Table 1 for drawing No. 7747, Fig. 1, gives each item for the setting up of the turret head, and also the individual time for the elements involved. This is considered the best method when first introducing instruction cards into the shop, as it proves to the operator that time has been allowed for each item. Another good feature of this method is, that if the time given is questioned, the operation can be checked direct from the card, without resorting to the filed data from which the time is taken.

When the operators have become accustomed to cards and acquired confidence in the time given, the second method, that for drawing No. 7746, Fig. 2 can be used to advantage. On this card, Table 2 gives the total time for setting up the turret head and a diagram, Fig 3, showing the set-up, is issued with the card. This diagram shows each tool used, and its relative position is indicated. A diagram of this kind is not necessarily held to exact scale, as a free-hand sketch will generally serve the purpose.

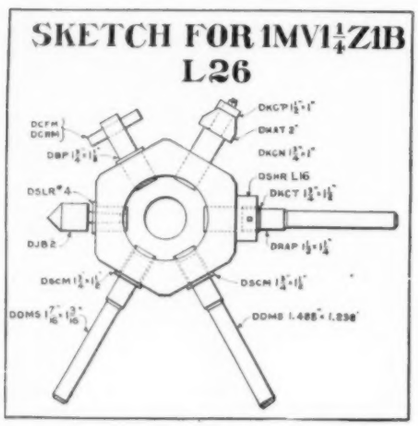


Fig. 3. Set-up of Tools Corresponding with Instruction Card Table 2

When instructions of this kind are issued, the symbol of each tool, or if symbols are not used, then the shop name of the tool, should be marked plainly on the diagram to avoid confusion. With the use of this method, a card can very often be shortened without destroying its efficiency.

Determining Standard Time Units

It will be noticed that the time units for everything, except the actual cutting time, are of three different kinds: The handling of the tools used in connection with the job; the handling or adjusting of the machine; and the handling of the materials. These same elements occur over and over in a great variety of jobs. They have been timed individually and tabulated, so that when a new job is to be planned, in order to ascertain the time that the job should take, a detailed description (instruction card) is written out, and the time for each of the elements is taken from the tabulated data.

Actual observations with a stop-watch must be made in order to determine the standard time units for each of the elements entering into its use; and each of the tools to be used must be studied in order to ascertain the time for performing each of the elementary operations connected with them. These data must then be properly classified and tabulated, so that they will be available for every job that may arise. It would be absurd to take an actual time study or stop-watch observation for each new job.

It is a simple, though tedious, operation to get the correct handling time for any turret lathe and the tools used thereon; but once the correct elements have been secured, the time for any combination can be readily computed. When securing standard records for machine-handling time, one must go further into detail than shown on the instruction card. The time for the minute details, such as picking up the tool or wrench, putting the tool in the turret, etc., must be taken and recorded, as this will allow a wide range of use for the elements recorded.

It must be understood that no claim is made that the time given for the two operations shown is the extreme minimum possible. The operations selected were chosen more to show the method than the time. The shop where these observations were made does not specialize on turret-lathe work; neither does it believe in driving a workman to a pace beyond which a good man can thrive under.

The orders for these pieces go through the shop in lots of 50 pieces, several times each year, and as a different operator may do the work on each lot it would

DM 11 — Symbol 1 *MV* 1¼ *V B.*

INSTRUCTION CARD FOR OPERATION.

1 Sheets, Sheet No. 1		Drawing No. 7746	Machine No. L 26	Order No. *MV* 1¼ *V*
Material Brass casting.	Class No.	Pieces in lot	Time for lot	Bonus

Description of operation

DRILL, REAM, FACE AND COUNTERSINK.

Item	Detailed instructions	Feed	Speed	Element time per piece	Time for entire lot	Continuous or running time
1	Change time card				2.00	
2	Study instruction card and drawing				8.00	
3	Put 2 jaw chuck on spindle				1.40	
4	Put *CCC* No. 3 in chuck and adjust jaws				1.10	
5	Change speed				0.40	
6	Set up turret as per sketch				6.60	
7						
8					19.50	
9	Put piece in chuck and secure			0.38		
10	Turn turret, start machine			0.10		
11	Center end with *DJB*	HF	336 3BF	0.24		
12	Turn turret			0.06		
13	Drill with *DDMS* 1.$\frac{7}{16}$x1.$\frac{3}{16}$	$\frac{1}{16}$ HF	3BF	0.42		
14	Turn turret			0.06		
15	Rough ream with *DDMS* 1.488x1.238	HF	3BF	0.42		
16	Turn turret			0.06		
17	Ream to size with *DRAP* 1.½x1.¼	HF	3BF	0.42		
18	Turn turret			0.06		
19	Countersink end with *DKAT*	HF	3AF	0.32		
20	Turn turret			0.06		
21	Put *DCRM* in *DPB*		89.9	0.18		
22	Rough face end	HF	3AF	0.40		
23	Change to *DCFM*			0.26		
24	Finish face end	HF	3AF	0.44		
25	Stop machine, gage and measure			0.36		
26	Take piece out of chuck and put in tote box			0.28		
27				4.52		
28	60 per cent. on handling time 1.86			1.12		
29	10 per cent. on machine time 2.66			0.27		
30				5.91		
31	Disassemble machine 6.00					
32						
33	Time for lot = (No. pcs. × 5.91) 6.00 19.50.					
34						
35	Time for 50 pieces = 321.00 or 5.4 hours...					
36						
37						
38						

When machine cannot be run as ordered machine boss must at once report to man who signed this card.	6 Month	8 Day	10 Year	Signed R. / Checked H.	

TABLE 2. TURRET LATHE INSTRUCTION CARD FOR PIECE SHOWN IN FIG. 2

be unfair to set a rate that only an extremely expert mechanic, who is thoroughly familiar with the operations, could make. It can readily be seen, however, that there is an advantage in having a standard method of operation for these pieces and holding each man to this particular method, as not one of them has ever been discarded on account of poor workmanship; and the time is almost invariably made.

Form DM 17 TOOL LIST | Operation Symbol 1MV 1.¼ VZ2B.

For Machine No. L 26. Draw. Nos. 7747.

Tools called for on this tool list must be issued in a tote box. The list should be placed in the tag pocket on the box and accompany the tools to and from machine.

Class	No.	Symbol	Size
Drill chuck	1	CCC H	¾
Center	1	CC HD	L 16
Form tool-holder	1	DSG U	No. 2
Socket	1	DSL P	No. 2
Center drill	1	D XS	No. 22
Micrometer	1	MCM	½
Turning tool	2	PATE	½
Forming tool	1	PATF	No. 667
Cutoff tool	2	PATL	¼
Wrench	1	WF H H	¾

Checks Req'd	Man's No.	Hour	Month	Day		Signed
[redacted]			6	8	1911	R.

When the tool list is not correct the gang boss must at once report the error to the man who signed this list.

TABLE 3. TOOL LIST CORRESPONDING WITH FIGS. 1 AND 2

Form DM 17 TOOL LIST | Operation Symbol 1 MV 1.¼ Z 1 B.

For Machine No. L 26. Draw. Nos. 7746.

Tools called for on this tool list must be issued in a tote box. The list should be placed in the tag pocket on the box and accompany the tools to and from machine.

Class	No.	Symbol	Size
Chuck jaws	2	CCCA	No. 3
2-jaw chuck	1	CCCP	L 16
Facing bar	1	DBP	1.¼x1.¼
Fin. face cutter	2	DCFM	4.¼
Rough face cutter	2	DCRM	4.¼
4 lip comb. drill	1	DDMS	1.488x1.238
4 lip comb. drill	1	DDMS	1 1/16x1 1/16
Countersink	1	DJB	2 in.
Fin. countersink	1	D KAT	2 in.
Sleeves	2	D KCM	1.¼x1.½
Countersink stem	1	D KC N	1.¼
Bushing	1	D KC P	1.¼x1
Bushing	1	D KC T	1.¼x1.¼
Reamer	1	DRA P	1.¼x1.¼
Floating holder	1	DS H R	L 26
Countersink holder	1	DSL R	No. 4
Plug gage	1	MGM P	1.¼
Plug gage	1	MGM P	1.¼
Wrench	1	WFSS	¾
Wrench	1	WFSS	⅞

Checks Req'd	Man's No.	Hour	Month	Day		Signed
[redacted]			6	8	1911	R.

When the tool list is not corret the gang boss must at once report the error to the man who signed this list.

TABLE 4. TOOL LIST CORRESPONDING WITH FIGS. 3

The tool lists shown, Tables 3 and 4, vary slightly from the ones actually used, inasmuch as the name of each tool is inserted opposite the tool symbol; whereas, when used in this shop, the class letter and descriptive classification only are given. The names of the tools are given here, so that one who is not familiar with the Taylor system of tool symbols can easily understand the use of each tool called for.

The difficulty of showing an instruction card that will not bring forth criticisms is fully appreciated. On one hand, the average manufacturer will look for a phenomenal time and method beyond reason, merely because it is under the Taylor system. On the other hand, the workman who may be opposed to scientific management will endeavor to prove that the time given is beyond human endurance.

The time and methods for both operations given are based on facts, and are correct for the shop in which they are used. The time can be made by any good turret hand, without physical distress, provided he follows the card instructions, and provided conditions are kept up to the standard that existed at the time the observations were made.

A Sanitary Water Cooler

BY C. A. HARRINGTON*

The health of all employees should be a matter of prime importance to the shop superintendent or manager, not only from a commercial, but also from a humanitarian point of view. In all modern shops, although positive action is taken to reduce the number of accidents by the installation of various types of safety devices, one frequently sees a fruitful source of disease in the use of the old-fashioned drinking cup.

Many states have passed laws prohibiting the use of common drinking cups or glasses on railroad cars, at public drinking fountains, in hotels, etc., but in many factories and shops, including even some of the government shops, the evil still exists.

How an ordinary water cooler may be fitted up at slight expense so that germs are not likely to be transmitted from one person to another, is shown in Fig. 1. There is no possible excuse for the use of the old-fashioned water coolers and the public cup at the present day, and it is hoped that they will soon be eliminated from all shops and factories.

A detail of the bubbler, which was fitted to the water cooler, and which has been found very satisfactory, is shown in Fig. 2. As will be apparent from the cut, the water from the cooler enters at *A* and bubbles up through the center cone. The waste water is collected in the outer cone and conducted through the pipe *B* to a drain bucket located in a convenient place. The height of the bubble may easily be governed by the distance from *A* to the surface of the water in the cooler, a height of three feet giving very good results.

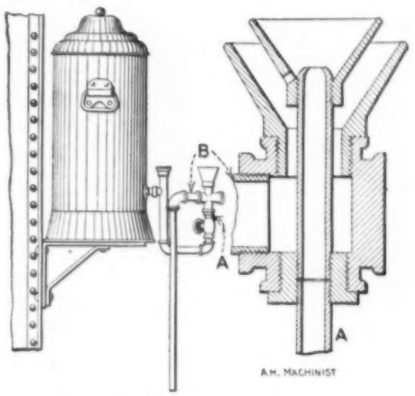


FIG. 2. DETAILS OF BUBBLER

FIG. 1. BUBBLER FOR WATER COOLER

*Assistant Naval Constructor, U. S. N., Portsmouth, N. H.

An Automatic Annealing Furnace

By Christian F. Meyer

A hardening and annealing furnace in which the intensity of the heat and the duration of the time the work is exposed to the heat can be controlled to give uniform results.

The furnace described was designed to automatically anneal small brass and copper shells which were to go through a drawing operation in the punch press. It may, however, also be used advantageously as a hardening furnace. This is done by exact regulation of the heat supply, as well as the furnace speed. Its greatest advantage is, that any unskilled laborer or even a boy can operate it without difficulty after it is set. All he has to do is to put the pieces which are to go through the furnace into the feed opening. Other advantages are, the quick and accurate work, the clean appearance of the work after it has passed through the furnace and, the fact that all pieces hardened or annealed are respectively uniformly hard or soft.

Parts of the Furnace

The furnace consists of the following parts: A large cast-iron ring *A*, Fig. 3, is mounted upon three vertical pipes. This ring is provided with a number of brackets *B*, Fig. 1, which have a sheet-iron plate *C* riveted to them in such a way that *C* completely surrounds the ring *A*, which is turned off to suit *C*. A cast-iron cover *D* terminates the so-formed cylinder at the top. The pipes supporting *A* are held in position by a three-armed bracket *E*, Fig. 3, whose center coincides with the center of the ring *A*.

In the center of *E* a strong steel bolt *F* is held by two nuts. This arrangement makes an easy adjustment of *F* possible. The square head of *F* is bored out to receive two hardened and ground-steel disks *a*. On top of these disks runs a hardened journal *b* driven into the vertical mainshaft *G* and fastened to it by a steel pin *c*. The shaft *G* has a shoulder against which the bevel gear *H* is held by a setscrew. A key prevents the gear from turning around the shaft. The bracket *I* holds the driving shaft *K* with its collars *d* and *e*. The bracket may be fastened to any suitable place at the bottom of *A*. The bevel-gear pinion *L* is fastened to one side of *K* to mesh with the gear *H*, while the other end of *K* is provided with a pulley, gear, or some other means to drive it.

The vertical shaft *G* runs through the long hub of *A* and is guided in it by two bushings *f* and *g*. The top part of *G* is provided with another shoulder upon which rests a cast-iron ring *M*. The latter is held to *G* by a setscrew and a key and revolves with the shaft in an opening left in the cover *D* for that purpose. The ring *M* is constructed with the six arms *h* and has a number of hubs *i* equidistant around its circumference. The hubs *i* serve as bearings for the shovel *N*.

The Shovels and Their Construction

The construction of these shovels *N* is clearly shown by Fig. 4. They are made of cast steel and provided with a small shaft *k* which turns easily in the hubs *i*. At the outer end of *k* a small bracket *O* is fastened against a shoulder in such a way that it revolves with the shaft. The bracket *O* is provided with two rollers *l* and *m* as shown. The lower roller *m* runs upon the lower guide ring *P* and the upper roller *l* works against the upper

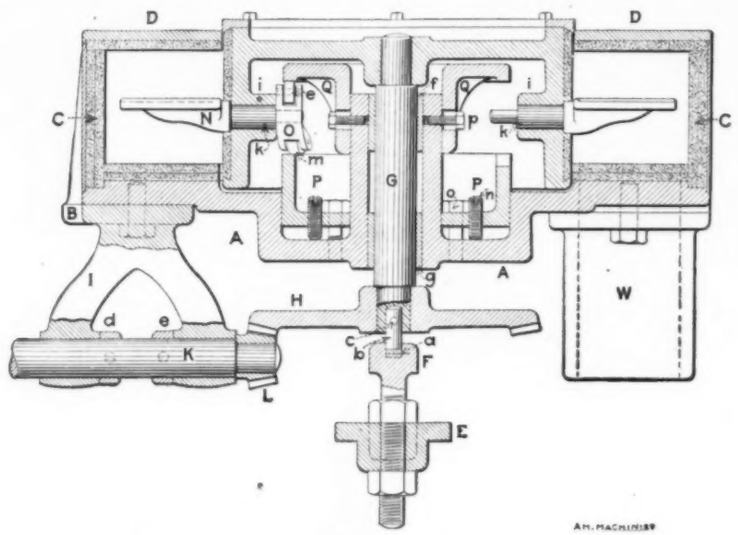


Fig. 1. Longitudinal Section of the Furnace

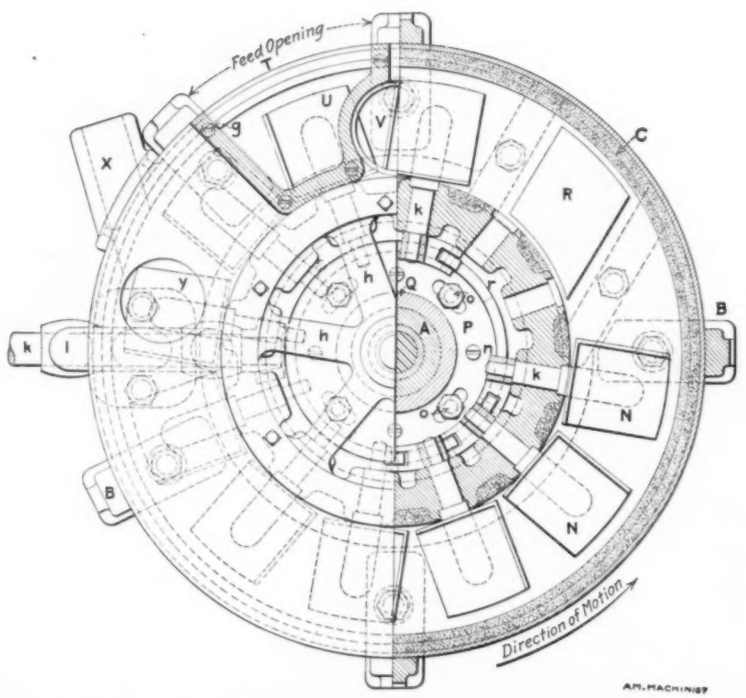


Fig. 2. Top View of the Furnace

guide ring *Q*, Fig. 1, while the machine is in motion.

The guide ring *P* is adjustable in a vertical direction and may also be partly revolved around its center. These adjustments are made by means of the screws *n* and *o*, the latter working in rounded slots, as shown by Fig. 2. This figure shows a top view of the furnace. The right half is cut away to the center lines of the shovels *N* to show the interior arrangement clearly. Two shovels are taken out at the same side to show the discharge opening *R*. At the left side the shovels are not shown at all to avoid confusion.

The upper guide ring *Q* is fastened to the hub of the ring *A* by means of the screws *p*. Longitudinal slots in *Q* provide for an adjustment in a vertical direction. The entire outer or fire channel which is formed by *A*, *C*, *D* and *M* is lined with thick layers of asbestos or fire clay, see Fig. 1. The course of these layers is interrupted by openings at several places; in the first place at the feed opening *T*, Fig. 2, which is formed by a cast-iron bracket *U* fastened to the cover *D* by means of the screws *q*. (See cross-hatched part around *T*.) At the one side *U* leaves enough room for the shovel and work to pass into the fire channel, while at the side where the shovels leave the channel again there is only enough room for the shovel itself to pass; thus the hands of the operator are protected against the flame.

In addition a round opening *V*, directly before the feed opening, receives a chimney to draw the flame away from *T*. At the same time this chimney achieves a better circulation of the heating gases. Shortly before the chimney opening *V* the bottom of *A* shows the discharge opening *R* which opens into a funnel *W* fastened to the bottom of *A*.

Right after the feed opening has been passed (moving in the indicated direction of motion of the furnace) the inlet *x* for the heating gases is riveted to the sheet-iron cylinder *C*. The gases are blown through *x* and ignited by means of an opening *Y* provided in the cover *D* in front of *X*. The opening *Y* is covered with a mica cover and serves also as an observation opening. If necessary a second inlet may be fastened at any suitable place along the channel.

Operation of the Shovels

The operator lays the work upon the shovels as they pass the feed opening. It then passes through the fire channel, and, according to the speed of the furnace and the intensity of the heat reaches a certain temperature by the time it comes to the discharge opening. At this point each shovel suddenly turns and throws the piece carried through the funnel into the annealing or hardening bath placed underneath. The shovel then turns back to its normal position again and passes into the feed opening.

The positive movement of each shovel is assured by an arrangement, the scheme of which is shown by Fig. 5. The bracket *O* holding the shovel *N* in a horizontal position runs between the guide rings *P* and *Q* guided by the rollers *l* and *m* (See position 1). In the lower guide ring *P* there is a cutout *r* while the upper guide ring *Q* has a spring *s* set in directly opposite *r*. The upper roller *l* runs upon this spring and compresses it (See position 2) while the lower roller comes to the edge of the cutout *r* (See position 3).

As soon as the roller leaves the edge it is thrown down by the spring *s* since the cutout is shaped according to the arc which the roller *m* describes about the center of *K*. Consequently the shovel *N* is also thrown around, thus throwing the work into the funnel *W*. An additional knock is given to the shovel by the sudden stop of the roller *m* caused by the fact that the arc of the cutout is shorter at the bottom than the arc described by *m* about the center of *k*. Position 5 shows the shovel going back into the horizontal position, and in position 6 it is ready to pass into the feed opening again.

In building this furnace care must be taken, however, to design all parts with allowance for expansion and contraction due to the heat of the furnace.

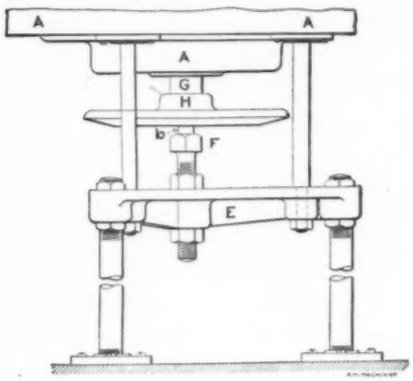


FIG. 3. FURNACE SUPPORT

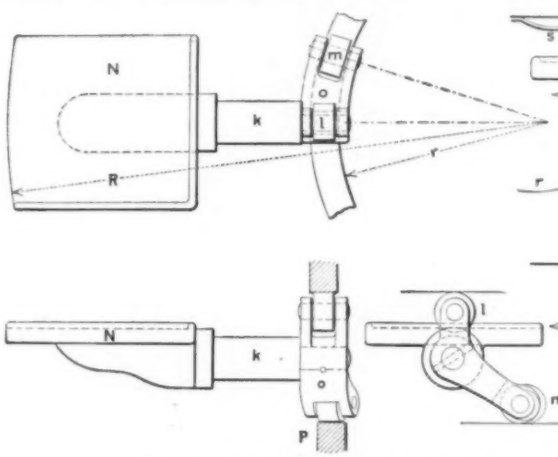


FIG. 4. FURNACE SHOVEL SUPPORTS

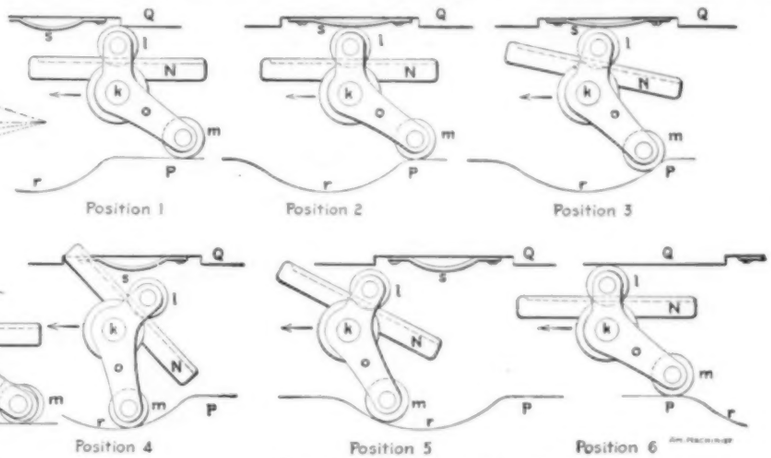


FIG. 5. ACTION OF THE SHOVELS

A Few Job Shop Tools

By E. A. Thanton

Besides manufacturing a small gasoline engine, Gladish Bros., Chattanooga, Tenn., do an extensive repair and jobbing business, and while the nature of their work does not lend itself readily to jigs and fixtures, there is a number of things of interest in their shop.

At *A*, Fig. 1, is shown a fixture which is threaded at *B* so as to screw onto the nose of a lathe spindle. Single cylinders are strapped to the plate *C* to be bored or ground. This fixture is adapted to both new and repair jobs.

For grinding out the bore a tool-post grinder with a specially long, heavy spindle is used. At *D* is a faceplate fixture used for holding crankshafts of various kinds. This fixture may be set off center if desired, and the driver *E* is made so that it may be turned in the sleeve of the fixture, a clamping screw being placed at *F*.

The fixture *A*, Fig. 2, is also made to screw onto the lathe spindle and is used to hold pistons while boring the wrist-pin hole. This fixture will hold a wide range of sizes, as the two setscrews *B*

and *C* tend to force the piston against the opposite side as in a V-block. The boring is done through the hole *D*. For pistons considerably smaller than the large hole, additional bushings are provided.

A connecting-rod drilling, reaming and facing jig is shown at *E*, and needs no explanation, except that split adjusting collars are used at *F* and *G* instead of the common solid ones.

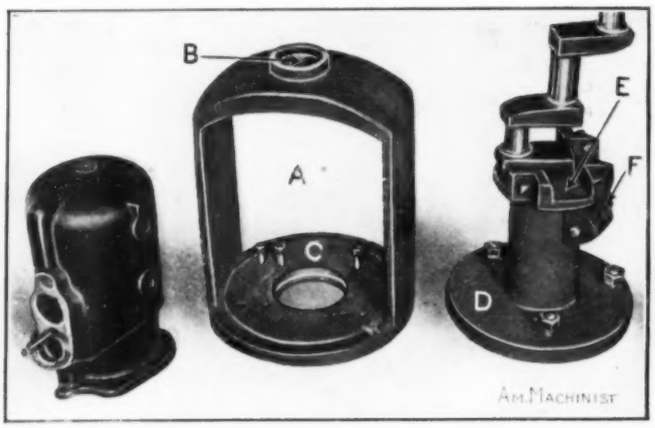


FIG. 1. CYLINDER AND CRANKSHAFT FIXTURE

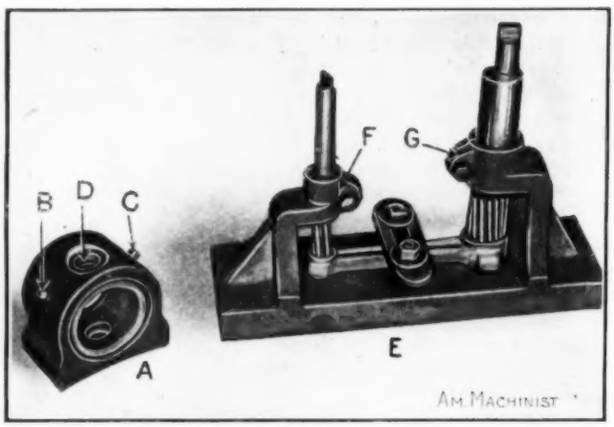


FIG. 2. PISTON AND CONNECTING-ROD FIXTURE

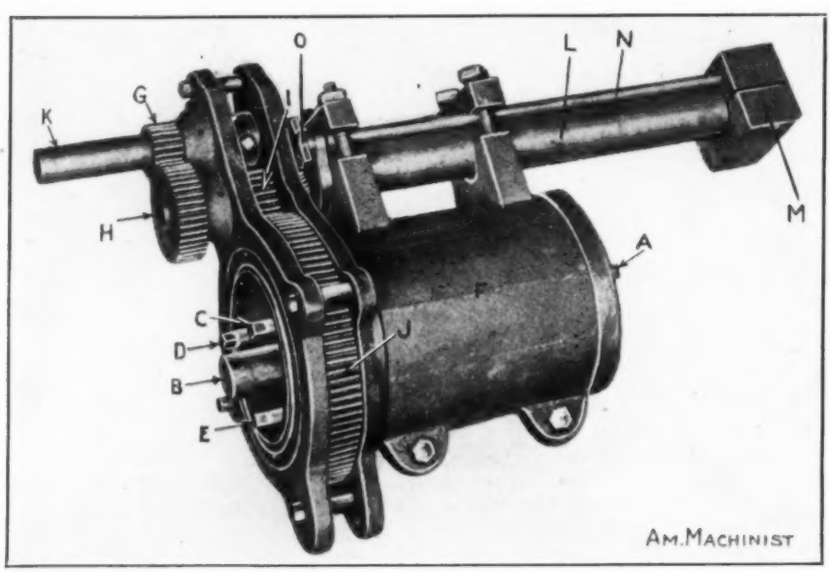


FIG. 3. PORTABLE WRISTPIN TURNER

A WRISTPIN TURNER

The shop is often called upon to repair large stationary engines, and in cases where the wristpin needs refinishing, the device shown in Fig. 3 is used.

As a rule such wristpins have been drilled and tapped for a grease cup in the end. This tapped hole is used to hold the fixture in place, the threaded end *A* of the bar, or bolt *B*, being screwed into it. This bar goes through a hole in the head of the fixture next to the wristpin, and the hole is made a little larger than the stem of the bolt, so that the fixture may be shifted enough to bring the wristpin exactly central.

Since the end of the pin might not be exactly square, three long setscrews *C*, *D* and *E*. are provided to use in lining up the cutter bar parallel with the wristpin. The cutter bar is carried on a sleeve *F* which is made to rotate around the body of the fixture, being driven by means of the gears *G*, *H* and *I*, which act on the stationary gear *J*. These small gears are operated either by a crank or a small motor on the shaft *K*.

The cutter bar, or guide *L*, is splined its full length and the tool-holder *M* is keyed to, and slides on it, being fed along by the screw *N*, operated by the star wheel *O*, which strikes a pin on the side of the large gear casing at each revolution of the sleeve. The feed screw used is of rather fine pitch, and with care a very satisfactory job is accomplished.

A Combination Boring, Facing and Threading Tool

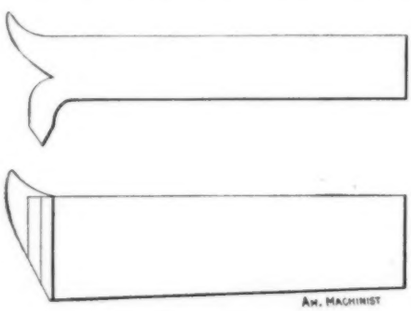
BY FRANK ROSE

A combination boring, facing and threading tool has recently found a place in our shop. A description of this tool and its use follows. The cut shows the tool.

On work of the character mentioned the tool has been found to be of much practical value.

It is used in the lathe on a large quantity of thin brass nuts, manufactured at frequent intervals. These nuts have usually been more costly than some other work of a similar nature done in the turret machines. This tool has reduced the cost and time so that the turret machines have lost their reputation.

It is a time-saver in several ways. It formerly took longer to shift and change the boring and facing tool, and reset the thread tool each time than to do the actual work on each nut. With this device, this time is saved.



A BORING, FACING AND THREADING TOOL

To use the tool it is only necessary to properly set the thread-cutting branch of the tool in the usual manner, and the rest of the tool takes care of itself. To face and bore, the lathe is run backward, and then the thread is cut. If the nuts are free from sand, a large number may be cut with the one setting of the tool.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Ring Patterns

Pattern makers frequently find it necessary to make two patterns that will produce a complete ring from four castings. Fig. 1 shows a typical case, *B* and *C* being the desired castings.

To avoid patching the joints, the usual method of procedure is to glue up two

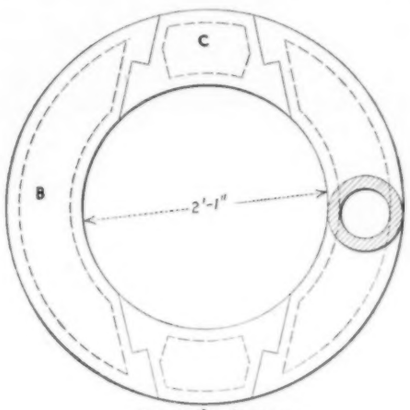


Fig 1 The Castings

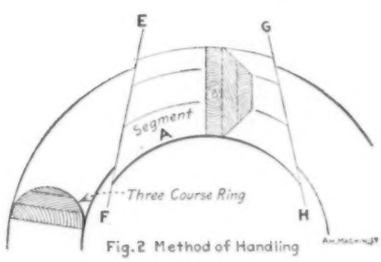


Fig.2 Method of Handling

RING PATTERNS

half-rings, turn to template in the lathe, cut off what is needed from the second ring and discard the rest.

Considering the waste of time and material this is a most unsatisfactory method, as it is seldom that one-quarter of the second ring is used. It also happens that a slight inaccuracy in turning appears very large when the two separate rings are placed together.

The proper way to handle such cases to obtain the best results at the lowest cost is shown in Fig. 2. First glue up one half-ring of three courses as shown, also a small segment *A* which, of course, must be slightly longer than the finished pattern.

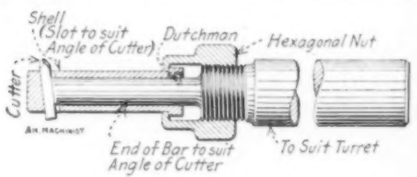
Before fastening the ring in the lathe make two shallow saw cuts on the back on the lines *EF* and *GH* which correspond to the size of segment *A*. After turning the ring to template and while the pattern is still in the lathe, saw out the piece corresponding to the segment *A*, using the saw cuts as guides. Insert the segment and fasten securely.

It is then a quick and simple matter to turn the segment *A* so that it conforms to the finished ring. The extra section having been obtained the completion of the pattern needs no further explanation.

New York, N. Y. S. E. MEKEEL.

A Boring Bar Tool Lock

The cut shows a boring bar designed to do away with the conventional setscrew to tighten the cutters in position. The



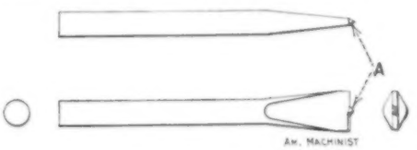
BORING BAR TOOL LOCK

advantage of this type of bar will at once appeal to practical men, as the cutter can be secured with more tension than is possible with a slotted setscrew when boring small holes. C. W. PUTNAM.

Philadelphia, Penn.

Tit-Drilling Round Holes

I have noticed from time to time articles on how to drill round holes through thin pieces, and would like to point out that the tit drill shown in the illustration is the best tool I have seen for the job. I once worked in a shop where not



THE TIT DRILL

less than 20 sizes of these drills were used, ranging from ⅛ up to 1½ in., and even the largest size cut a nice, round hole through stock ⅛ in. thick.

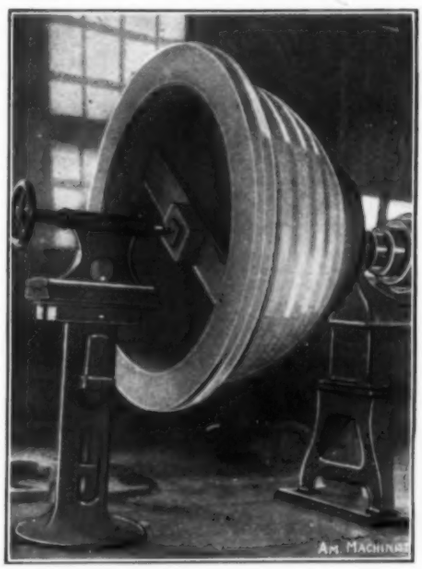
The tit *A* is a rhombus pyramid, which does not cut very well, but in forcing its way into the stock, forms a rigid axis for the cutting edges to rotate around. It should not be more than $\frac{1}{16}$ in. long for the smaller, or ¼ in. for the larger drills.

I have used this drill sometimes for hogging out stock on drop-forging dies, as it leaves less metal to mill at the bottom of the impression.

Brooklyn, N. Y. F. J. BADGE.

A Device to Prevent Chatter

The illustration shows how a temporary steady device was provided for turning a large pattern that extended 3 ft. from the faceplate. This pattern was built up and turned both inside and out-



A DEVICE TO PREVENT CHATTER

side without rechucking. The diameter of the flanges was 6 ft.

Most pattern makers know what a time is in store for them when turning a pattern of this type. While passing through an ordeal of this kind recently, we were inspired with the idea of using the base of a floor trimmer, with the tailstock of a turning lathe mounted thereon. This arrangement worked very satisfactorily.

The equipment can be found in almost any pattern shop, can be arranged quickly, and is much more satisfactory than a device consisting of wooden braces, etc.

Dayton, Ohio. H. A. LARRY.

Supporting Line Shafting in Structural Steel Buildings

In buildings where the roof trusses are very high, too high for the line-shaft hangers to be secured to the roof truss, other means must be resorted to.

This support was designed to carry the line shafting and pulleys in a large forge shop where the belt pull is not uniform on the machines, such as board drop hammers, presses, etc., in which the belts have a tendency to jar the shafting.

Referring to Fig. 1, brackets as shown,

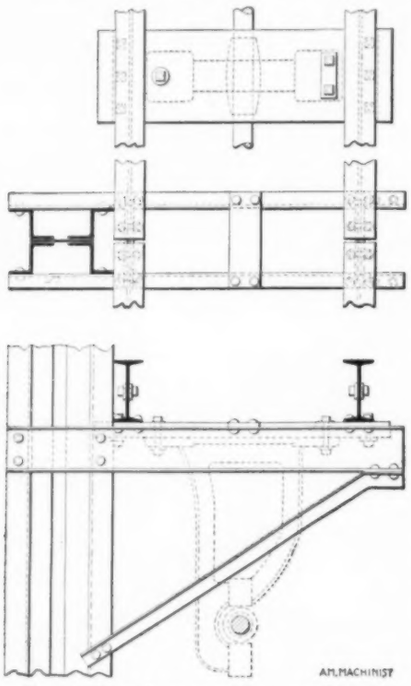


FIG. 1. THE SUPPORT FOR THE SHAFT

were made from structural steel and riveted to the building columns. The columns are spaced 15 ft. center to center; 8-in. I-beams are bolted on top of the brackets to carry the line-shaft hangers, which are bolted to the bottom of the I-beam. The hangers are spaced 7½ ft. center to center. Oak timbers, 4x12 in., are bolted between the 8-in. I-beams and hangers, thus allowing larger pulleys to be used on the line shaft.

The line shafting is located 17 ft. 10 in. above the floor line; this allows the machinery to be placed closer to the line shaft, so that more floor space can be utilized in the center of the bays.

The first section of shafting is 2 11/16 in. in diameter where the line-shaft pulley is secured; the shaft is driven by a 40-hp. motor. The rest of the shafting is 2 7/16 in. in diameter. There are three independent line-shaft drives. This has an advantage in case of a breakdown as the whole shop need not then be shut down. Furthermore, when the machinery is not in use on one of the shafts the motor can be shut off and power saved.

In order to keep the motor out of the dirt and dust that abounds in forge shops, the floor is usually loose ground or cinders. A platform was constructed, as shown in Fig. 2. Two 3-in. wrought-iron pipes with flanges screwed on each end are used for the supporting columns. In order to make the columns rigid, diagonal braces were screwed to the columns and braces as shown secured to the columns and wall.

Two cast-iron brackets were bolted to the wall, and two 8-in. I-beams were bolted on top of the brackets and columns, which are used to support the timbers for the floor and where the motor is secured.

Two braces were made from 1-in. round iron, with ¾x2-in. ends; one end was bolted to the front of the 8-in. I-beam and the other end to the brick wall. The braces make an angle of 45 deg. between the wall. This makes the platform very rigid. The motor base is bolted to two 4x8-in. oak timbers, which are bolted to the 8-in. I-beams.

The floor of the platform is made from 1¼-in. oak timbers, and 1-in. iron railing is secured around the outside edge of the platform so that when a man is working around the motor he cannot accidentally step off the platform. An iron ladder is bolted to the wall so that the motor may be easily oiled or repaired.

The starting box, switch, etc., were located directly under the platform and secured on the wall about 6 ft. above the floor line, so that the motor could be easily started from below.

W. H. WOLFGANG.

Toledo, Ohio.

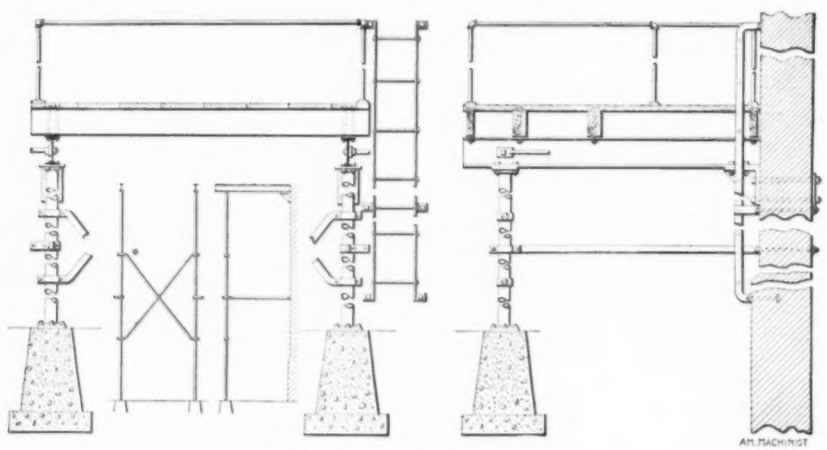
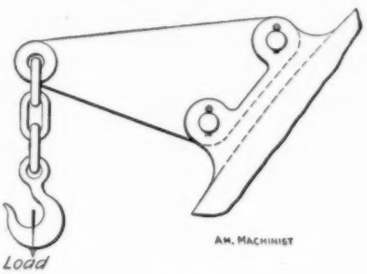


FIG. 2. THE MOTOR PLATFORM

A Problem in Statics

Knowing your interest in problems that will keep your readers thinking I beg to offer the following:

A bracket as shown is attached to a machine frame by means of two pins fitting



A PROBLEM IN STATICS

perfectly the reamed holes in the bracket and the frame. A load is suspended from the end of the bracket. What will be the directions and magnitudes of the pressures at the pins?

Any proportions and load may be assumed.

H. A. S. HOWARTH,

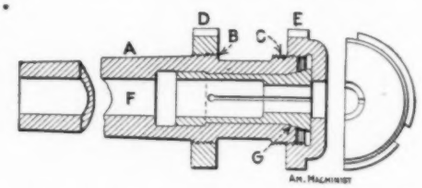
Assistant Professor of Mechanical Engineering, Lehigh University.

So. Bethlehem, Penn.

A Draw-in Collet Attachment

A cheap and efficient draw-in collet set for the toolroom engine lathe may be made with very little expense and will answer just as well as the regular made-to-order attachment.

In our toolroom we have a No. 2 Brown & Sharpe universal miller, equipped with a spring chuck attachment with a set of collets ranging from ⅛ to ½ in. by thirty-seconds. We have a great many small flat drills, end mills



AN ENGINE-LATHE DRAW-IN COLLET SET

and similar tools made of drill rod, which we use in our general manufacturing work. These tools are made in our toolroom, 25 or 50 at a time.

We realized that we could make a big saving in their manufacture if we could use a draw-in collet attachment. This attachment fitted to our lathes complete with collets would cost us about $75, an expense that would hardly be justified. We accordingly began to figure how to get around this, and determined as follows:

We turned a piece of tool steel to fit the taper of our lathe. The shank *A* was then fitted to the spindle of the

lathe and the threads *B* and *C* chased to fit the collars *D* and *E* of the spring chuck attachment. A 5/16-in. hole *F* was bored through the piece to allow the drill rod to pass, and the taper hole *G* was ground with a tool-post grinder after hardening, to correspond to the similar taper of the spring chuck.

Now by simply using the set of collets, collars and spanner wrench we have a fairly efficient draw-in collet attachment. We have only the one set to care for, and since the two attachments are seldom used at the same time, we could ask for nothing better. The cost of making the attachment is less than five dollars.

A. B. COOPER.

Marshalltown, Iowa.

Chuck for Thin Bushings

The development of inside grinding has brought up the problem of grinding holes in bushings and sleeves which have very thin walls. Where the walls are less than ¼ in. thick and the hole diameter 1 in. or over, it is almost impossible to hold a piece without squeezing it out of shape, for if a hole is to be ground to a plug size, the piece must be held firmly enough to enable the operator to try the plug in it without disturbing the location of the piece, and the only way to do this is to clamp it endwise.

The Heald Machine Co. has developed a bushing chuck for this class of work. The construction of the chuck is shown in Fig. 1, and the halftones give some idea of the work to which it is adapted.

Pieces are located by means of a three-sided plug in the rough-bored hole. The plug is centered by a pilot at one end, and fits the screw cap at the other end. The screw cap holds the bushing by endwise pressure, and does not distort it.

The chuck, with the screw cap *A* and the locating plug *B* is shown in Fig. 2. What appears as the bottom of the chuck is, in reality, a threaded collar, which can be located anywhere in the chuck to accommodate different length bushings. Fig. 3 shows the locating plug in place with a bushing on it at *A*. Another bushing, which has just been ground, rests on the bridge at *B*.

The cap screwed onto the chuck is

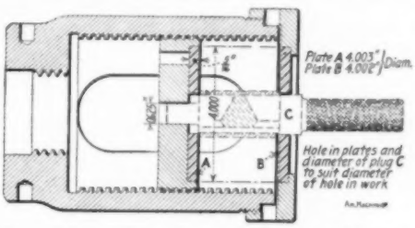


FIG. 1. DETAILS OF THE BUSHING CHUCK

shown in Fig. 4. The locating plug has not been removed. Fig. 5 shows the plug removed and the job ready to be ground. The nozzle of the water pipe may be seen through the opening in the side of the chuck. The water comes from the pipe at the rear of the spindle, and flows through the bushing to be ground, keeping it cool and free from dirt.

This chuck may be used for many kinds of internal grinding, where the pieces have either one or both ends open. Where a large number of pieces are to be ground, it is sometimes necessary to make two locating plugs of different sizes, to allow for the variation in size of the holes after the pieces have been through the fire.

This chuck has been in use for some time, handling work that could not be held satisfactorily in a regular three-jawed chuck.

WILBUR C. SEARLE.

Worcester, Mass.

Rough-Boring a Large Lever

In Fig. 1 is depicted a successful method used for rough-boring a large lever boss. The lever being too long to chuck, some special, simple and fast method had to be devised. A large angle plate, which had a bracket with a V-groove to fit on the lathe bed, was attached to the carriage. A large boring bar, carrying the cutter, was driven through the chuck on the lathe head, and was supported by a steady-rest at the rear. By mounting the work on the carriage in this way it can easily be fed over the cutter.

An end view of the work, angle plate and method of locating, is shown in Fig. 2. The three locating blocks used are shown in detail in Fig. 3. These are held to the angle plate by half-inch setscrews and washers, as shown. The blocks have half-inch setscrews, which pass clear through them and upon which the work rests. The work is located from the outside diameter of the boss.

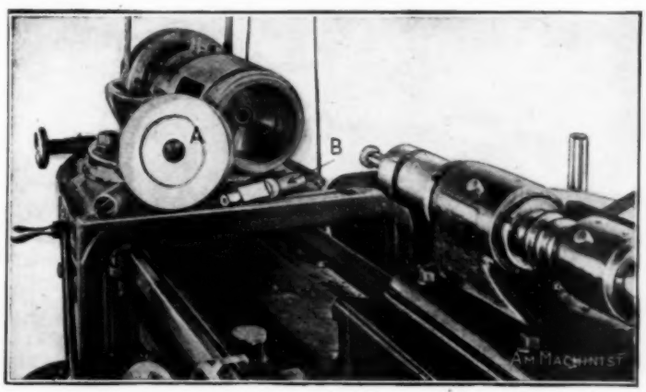


FIG. 2. CHUCK, SCREW CAP AND THREE-SIDED PLUG

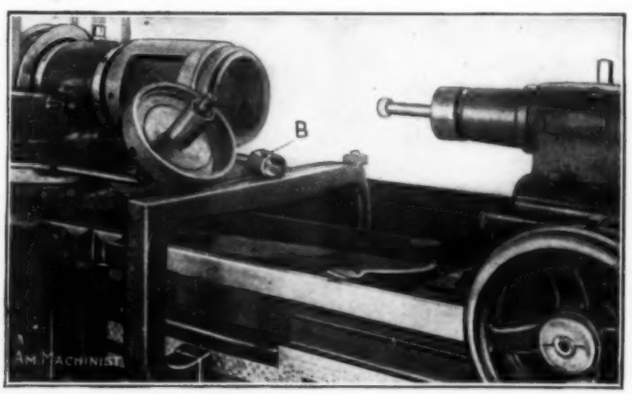


FIG. 3. CHUCK READY TO BE CLOSED

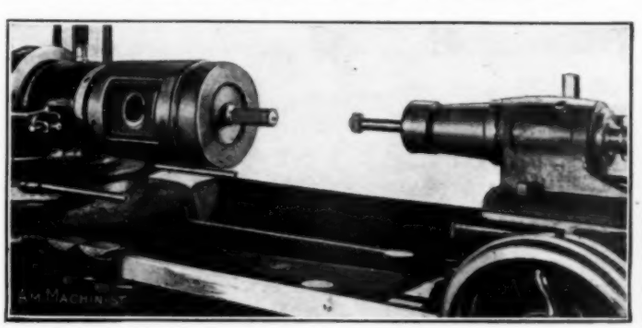


FIG. 4. CHUCK CLOSED; PLUG STILL IN PLACE

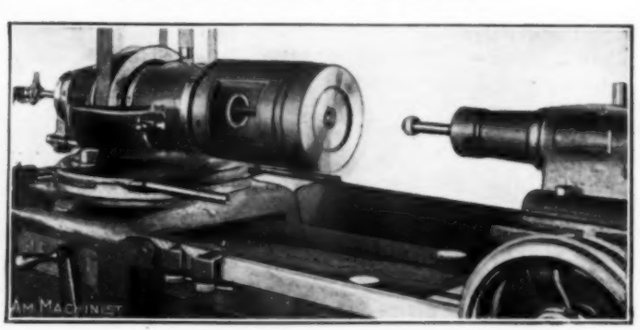


FIG. 5. PLUG REMOVED; READY TO GRIND

At the top of the angle plate the work is held by a very useful clamp, which permits the work to be set at any angle. The advantage of this style of clamp is that it is self-locating in most cases and that work can be held more rigidly with it than with the ordinary method of clamping. A detail of this clamp is shown in Fig. 4. It has a slot which passes over the work, one side having two setscrews for rigidly clamping it to the work, while set at right angles to this slot is another slot, which passes over the top of the angle plate. A setscrew is used here also to hold the clamp rigidly to the angle plate.

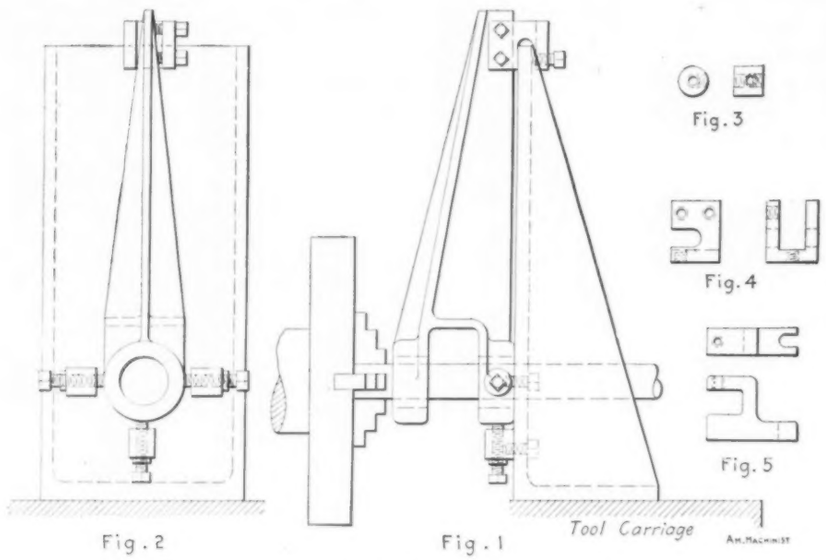
From this it can be seen that the method of locating the work is quite simple after the first piece has been set up in the lathe. It is only necessary to remove the clamp at the top, which does not enter into the locating method at all, and one of the locating blocks at the side of the boss. Of course, it is necessary to remove the boring bar, although this practically remains located, as it can be slid back and forth through its bearing in the steady-rest.

The angle plate has a number of holes drilled into it, so that various sizes of levers can be rough-bored in this manner. A point which should be considered is that the angle-plate base should be recessed, so as to get the steady-rest as near the cutter as possible, the advantage in this being that a heavier cut can be taken, as the boring bar is much stiffer.

Various classes of work can also be done in this manner, and when the work is held by clamps from the side of the angle plate, slots could be provided in the ribs to permit the insertion of the clamp.

In Fig. 5 is depicted a clamp similar to Fig. 4, but designed for use on millers and keyseaters. This clamp is also self-locating. The work is placed in the large slot and held by means of a setscrew. The clamp is held to the machine table with the usual T-bolt and nut, two of these clamps being used. A noteworthy feature of this type of clamp is that its position on the machine table is always maintained, not being disturbed by removing and replacing work on the machine table, every piece being held in the same manner.

St. Louis, Mo. C. T. SCHAEFER.



ROUGH-BORING A LARGE LEVER IN A LATHE

A Novel Type Bar Swaging Die

The illustrations show a type-bar swaging die, Fig. 1, of novel construction, and two pieces of the work, Fig. 2, before and after having passed through this die.

Referring to Fig. 1, blocks *A* and *B* are the dies proper; *C* is the pin over which the blanks are placed and located by swinging over the die *B* and against the pin *D*.

As originally built this was all there was to the die, but it was soon found that the constant hammering did not take long to wear a hole in the die as the blanks were all located in one spot. As the die was in constant use and the pieces had to be held close to size some means had to be found to overcome this.

The die was made by casting a special die bolster, one end of which was cored out to receive a drum cam *E*, which is fastened on the shaft *F*. At the left of the cam and fastened to it is a ratchet *R*, which is actuated by the pawl *N* through the arm *M*. The locating pins *C* and *D* are mounted on a slide *G*, the bolster being planed out to receive the slide, which is held down by the guide strips *HH*.

Into the slide is also fitted the pin *K*, which is acted upon by the cam *E* and

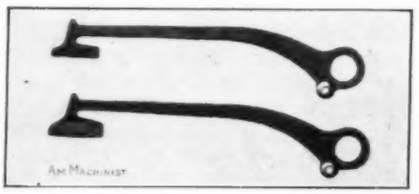


FIG. 2. THE TYPE BAR

moves the slide back and forth. This action is brought about in the following manner: As the press ram descends it carries the upper die and also the pin *L* (which is fastened in the upper die holder) down, pin *L* striking the arm *M*, which carries the pawl *N*, raises the pawl until it engages the next tooth in the ratchet. Then as the ram rises and the pin *L* releases the arm *M* the spring *P*, pulling on the pawl, revolves the cam a short distance and the cam, acting on the pin *K*, moves the slide in or out as the case may be, and in that way changes the position of the blank on the die every time the press is tripped, thus increasing the life of the die.

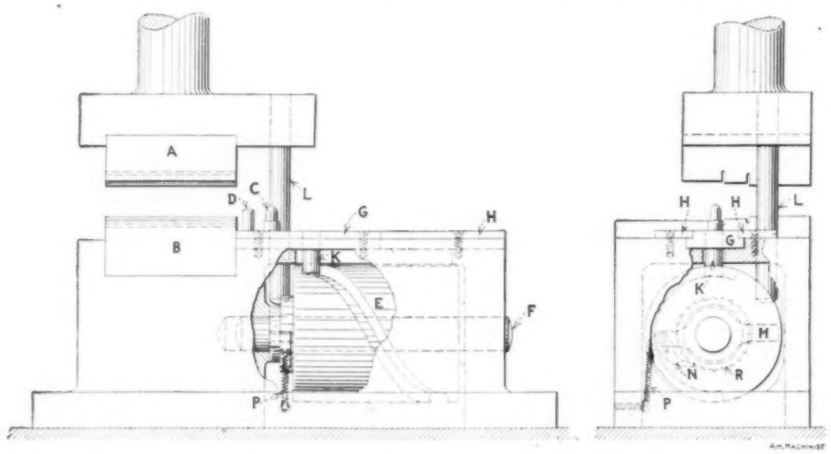


FIG. 1. A NOVEL TYPE-BAR SWAGING DIE

Syracuse, N. Y. DONALD BAKER.

Mechanical Engineers' Spring Meeting

Editorial Correspondence

A variety of papers, of which those dealing with new processes of chilling and hardening cast iron, and the strength of steel tubes, pipes and cylinders, are of chief interest in machine-shop practice.

The Cleveland meeting of the American Society of Mechanical Engineers held at the Hotel Hollenden was the sixty-fifth of its history, it being 29 years since it previously met in Cleveland, in 1883, growing since that time from a membership of 300 to over 4000. The local members acquitted themselves creditably, both in the provisions for the meetings and the entertainments provided for members and guests. The registration was large for a spring meeting and the sessions well attended.

Mayor Baker delivered a splendid address of welcome in which he briefly suggested that engineers can and should play their part in the economic problems of the day as well as in those of a purely mechanical nature. He commented on their wonderful achievement as producers and pointed out that the problem of economical and equitable distribution was equally important.

An informal reception followed at the home of Mr. and Mrs. Ambrose Swasey in the afternoon, and a membership reunion at the Chamber of Commerce in the evening paved the way for the opening business and professional session on May 29.

After the usual business, including the election of about 300 members, papers were read on: "A New Analysis of Cylinder Performance of Reciprocating Engines," by J. Paul Clayton; "Equipment of a Modern Flour Mill on a Gradual Reduction System," by John F. Harrison and W. W. Nichols, and "Design and Mechanical Features of the California Gold Dredge," by Robert E. Cranston.

Simultaneously the Gas-Power Section presented papers on: "Problems in Natural Gas Engineering," by Thomas R. Weymouth; "Some Tests on Carburetors," by George W. Munro, and "Bituminous Coal Producers for Power," by C. M. Sarland.

Excursions in the afternoon included the Pennsylvania Co.'s ore-handling plant; Peerless Motor Car Co.; Warner & Swasey Co.; Brown Hoisting Machinery Co.; Winton Motor Car Co.; the White Co.; National Acme Manufacturing Co. and the American Steel & Wire Co.

In the evening, Dr. Dayton C. Miller of the Case School of Applied Science, lectured on: "Sound Waves; How to Photograph Them and What They Mean." This was illustrated with experiments and special apparatus, including the new instrument known as the "Phonodeik" for projecting sound waves directly upon the screen so as to be seen by an audience.

Chilled Irons

Thursday, May 30, two papers were presented by Thomas D. West, both on the subject of chilled irons. These were: "New Processes for Chilling and Hardening Cast Iron," and "Tests of Chillable Irons."

The first paper outlined a series of experiments to determine the effect of different methods of treatment in chilling or hardening cast iron during the process of cooling after pouring the mold.

The first experiments, showing how to produce mechanically mottled and white iron inside a gray body led to experiments with chillers used in different ways, and with various other heat-absorbing or hardening media, such as air, charcoal, powdered manganese, cyanide, etc. A study was made of the effectiveness of chillers of different thicknesses and of different metals; of the effect of cooling chillers, etc.

The experiments indicated, among other results, that the accepted idea of chilling occurring entirely while the molten iron is solidifying is wrong; and showed how stronger grades of iron can be used for car wheels, rolls, etc., and still obtain the desired depths of chill in such castings. They also demonstrated the superiority of air cooling over metal chillers.

The tests given in the second paper related to the relative strength of gray iron and of partly or wholly chilled iron, showing the best combination in chilled castings. Many tests were presented of chillable iron alloyed with vanadium and titanium.

Previous to these tests experiments were made for the purpose of establishing a size of round bars suitable for making tests of chillable irons where it is necesary to have the bars either of a uniform gray structure throughout or capable of being chilled throughout, the metal in each case being poured from the same ladle.

The effect was shown on the results of tests of different methods of locating the bar in testing with regard to the quality or grain of the metal. Attention was called to the advisability of drop tests for cast iron and to the complexity and sensitiveness of chillable iron mixtures, requiring delicacy in mixing, melting, casting and testing.

Discussion

Mr. Souther intimated that the irregularity between figures suggests the possibility of internal strains in the specimens and questioned whether they were relieved by partial annealing. He also pointed out that as the alloying elements were added in the ladle, a slight cooling was caused and a slight increase of strength was noted.

Prof. Henry M. Howe pointed out that the fact that the inside of the casting was white, showed it solidified as white iron. The graphitization of the outside must have occurred in that phase of the cooling by which the gray outside had outrun the white interior at the moment of quenching.

He inferred that this graphitization must have occurred within a very narrow range of cooling, presumably below the eutectic freezing point, because of the slight amount by which the cooling of the outside preceded that of the inside.

White cores in gray-iron pigs are usually considered due to pressure. If the outside becomes firm and rigid, the separation of graphite inside sets up pressure on account of its bulk, and this pressure tends to prevent the formation of graphite further in.

P. Munmic pointed out that this corroborated the work of E. A. Custer with castings made in chill molds, which show no signs of chilled structure provided the castings are removed from the molds immediately after casting. Other discussions were presented by Carl Hering, Paul Kreuzpointner, A. S. Dowler and James A. Beckett.

Steel Tubes

The paper on "The Strength of Steel Tubes, Pipes and Cylinders Under Internal Fluid Pressure," by Reid T. Stewart, showed that

(*a*) Clavarino's formula is theoretically correct for cylinders with attached heads, and Birnie's formula for heads held independently. These formulas are practically applicable to certain classes of seamless steel tubes and cylinders and to critical examination of ordinary commercial steel tubes, pipes and cylinders when sufficiently accurate data are available.

(*b*) In commercial welded pipe the variation in thickness of wall, perfection of weld, etc., account for variation in the bursting strength of sufficient magnitude to render unnecessary any consideration of Clavarino's or Birnie's condition of head support. All such variations give rise to errors on the side of danger when applying these formulas.

(*c*) For ordinary commercial wrought pipe Barlow's formula is to be preferred. This formula is.

$\frac{p}{f} = 2\frac{t}{D}$; $p = 2f\frac{t}{D}$; $t = \frac{1}{2}D\frac{p}{f}$; $f = \frac{1}{2}D\frac{p}{t}$

where

D = Outside diameter in in.

t = Nominal or average thickness of wall in in.

p = Internal fluid pressure in lb. per sq.in.

n = Safety factor as based on ultimate strength.

f = Fiber stress in lb. per sq.in.

$= \frac{40{,}000}{n}$ for butt-welded steel pipe

$= \frac{50{,}000}{n}$ for lap-welded steel pipe

$= \frac{60{,}000}{n}$ for seamless steel tubes

$= \frac{28{,}000}{n}$ for wrought-iron pipe

Other Papers on Hydraulic and Steam Engineering Subjects

Two other papers were: "The Control of Surges in Water Conduits," by W. F. Durand, and "Speed Regulation in Hydroelectric Plants," by Wm. F. Uhl.

The Friday session was devoted largely to steam-engineering subjects. The papers read being: "The Present State of Development of Large Steam Turbines," by A. G. Christie; "A Discussion of Certain Technical Properties of Steam," by G. A. Goodenough; "The Reduction in Temperature of Condensing Water Reservoirs Due to the Cooling Effect of Air and Evaporation," by W. B. Ruggles, and the "Results of Tests on the Discharge Capacity of Safety Valves," by E. F. Miller and A. B. Carhart.

The paper by Mr. Christie was a detailed comparison of all the large turbines, both here and abroad, and gave the performances of each under different conditions. These were extremely interesting and denoted very clearly that our European cousins have studied the matter in much detail and have secured some remarkable results.

In the *Metall-Technik*, a simple method of enameling metallic objects, accomplishing uniform results, irrespective of shape or size, is described as follows: The surface of the object is uniformly moistened by placing the object in a vapor bath, or playing upon it with a stream of vapor (dipping the object in water does not produce uniform moistening, because metals are apt to repel unatomized water); enamel powder is then strewn over the object through a sieve, and sticks uniformly all over it. To put on a second layer of enamel powder the process is repeated. After the powder is laid on, the object is placed in the furnace as usual. It is claimed that the absence of fluxes or binders of any kind helps the enamel to preserve its color, brilliancy and transparency.

A Chip Conveyor

By E. A. Dixie

In the shops of the Baldwin Chain Co., Worcester, Mass., the chips are removed to the scrap pile in the yard by means of the handy conveyor shown in the halftones. Fig. 1 shows the indoor end of the outfit.

Fig. 1. Indoor Arrangement of the Chip Conveyor

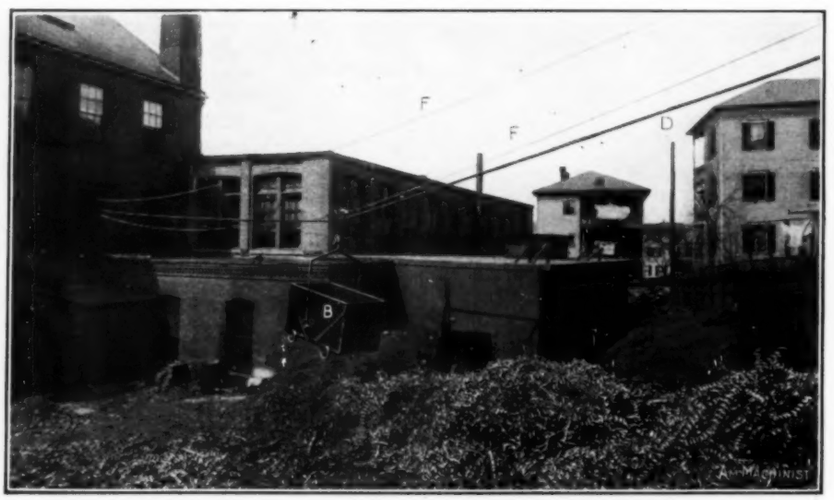


Fig. 2. Outdoor Arrangement of the Chip Conveyor

The regular overhead trolley system ends at *A*. A heavy steel cable *D* is stretched from the end of the trolley system to a stout pole in the yard. Running on *D* is the traveler *E*, which supports the dumping bucket *B*. Both ends of a continuous-haulage rope *F* are fastened to the traveler, as shown. The haulage rope passes over a V-grooved pulley, which is driven by chain from the crank *C*.

The bucket *B* is filled and runs by gravity the greater part of the distance to the scrap heap. An automatic trip on the bucket is operated by a line running from it to the inside of the door.

The outdoor arrangement is shown in Fig. 2. In the winter it is only necessary to have the door open long enough for the passage of the bucket, as holes are provided to accommodate the ropes.

The use of enameled cooking utensils and other enameled ware is now extensive and there is a wide difference in its quality. The enamel is all sufficiently non-corrosive to answer every requirement, but it is apt to flake off. Splinters enter food, or if ware other than cooking utensils is used, the flaking ruins the appearance of the surface.

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Of this issue, 25,000.

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OUTLINE OF TOPICS, PAGE 225

The last two years of Wilbur Wright's life stand as an indictment of our patent laws and procedure. In 1910 he gave up public flying to devote his time and energy to research work. He hoped to improve the mechanism of heavier-than-air machines and to discover and declare more of the principles underlying mechanical flight. This purpose he could not carry out as he wished, because of constant patent litigation.

Our loss from this situation we will never know. It is self-evident that a man cannot do research work and at the same time be in court fighting for his rights under a government-issued patent. What a pity that a man with his genius—genius that gave us the greatest invention of this generation—should be forced to spend his strength in litigation, because the only patent that he could get was open to attack on the part of competitors.

Mr. Wright's experience is typical. It is the greatness of his achievement and the popular interest in the art of aviation that he developed that bring his experience home to us with added force. Congress is at present considering numerous bills dealing with patents. It is evident that something will be done. Let us hope that some action will be taken to conserve the inventing and research ability of our people, through reducing the possibility of attacking and infringing a patent once issued.

American Machinist

Manufacturing vs. Making

Manufacturing, including the making of parts interchangeable rather than fitting each by hand separately; manufacturing, including specializing in a given line so that large quantities of a given product can be made; manufacturing, including the adoption of the unit system of design and the making and carrying of stock parts, constitutes what has become known as the "American Method"; the method of *manufacturing* as distinguished from *making*.

America, however, comes far short as yet of obtaining from this method all the benefits of which it is capable and in these days when the air is full of schemes for management, and when thoughts are concentrated on getting the greatest possible returns from a given amount of human effort, it may be well before turning aside to try new methods to endeavor to make the most of those already successfully started.

An illustration of what can be accomplished in the use of manufacturing methods is shown in the production of watches. Sewing machines and typewriters are other illustrations in point while a more recent development is in the manufacture of automobiles. An instance where several automobiles of the same kind and of American make were taken apart, the parts mixed up and then reassembled without regard to which parts went into each machine and the machines afterward put on the road and run successfully, is a demonstration of this and suggests also the great advantage such interchangeability gives in case of needed repairs as well as in economy of manufacture. This advantage is increased when repair parts are carried in stock for immediate delivery whether the line of manufacture be automobiles or other machinery.

Results such as those obtained in American machine-made watches as well as in interchangeable automobiles can be obtained only by starting at the beginning of the design and so planning the work as to be handled on a *manufacturing basis* by the use of a full equipment of special tools such as will secure a high standard of workmanship even when using unskilled help. The importance of the use of limit gages for such work has recently been pointed out by us in these columns.

Producing parts in large quantities makes it possible to use such methods, and in doing so there is not only the saving in rigging up for the job, and in having a smaller number of separate jobs to look after and handle, but there is also the possibility of further saving when the order is for such an increased quantity of parts, by reorganizing on a *manufacturing basis*, gating patterns, making use of machine molding, using drop forgings, etc., and producing automatically what was previously made by hand.

These, together with providing an equipment of special tools, warranted by the larger number of parts, can materially reduce the cost and bring about interchangeability while maintaining accuracy. American manufacturers should wake up to the, as yet, undeveloped possibilities of a system which they have been instrumental in giving to the world.

Standardizing Elementary Parts

In this issue we print an important article dealing with the standardization of elementary parts.

The suggestion is that many of the elements of machine parts can be standardized, and from these elements detailed designs of the parts themselves can be quickly and satisfactorily made. The standardizing of small parts, particularly screw-machine work, studs, pins, screws, washers, bolts and the like, has long been done in the majority of large machine shops. We are now asked to consider extending this standardization to cover hubs, bosses, yokes, rod ends, lever webs and the like.

The suggestion has a great deal of merit. We have seen finished drawings, and others in process of making, following the line of this suggestion. It is surprising how quickly details can be developed, provided a draftsman is given merely his center lines, center-to-center dimensions, and the diameters of studs, pins and other connecting parts. The work of designing levers, links, bell cranks and the like is merely the mechanical one of selecting dimensions from these tables, laying out the drawings and putting on dimensions.

Finished drawings of parts thus standardized show a surprising uniformity of detail over others made without such attempts to gain uniformity. Numerous advantages are claimed for this method. These are so well set forth in the ar-

ticle to which we have referred that they do not need to be mentioned here. It is but another step in planning work—systematizing accumulated experience, and then making use of it.

Thus far specialization has not gotten into the drawing room to a very great extent, but the tendency is unquestionably in that direction. The standardization of elementary parts will aid in that specialization, and at the same time will tend to give us better and more uniform final results, with less expenditure of time and effort.

New Publication

BRAZING AND SOLDERING. By James F. Hobart. 51 pages, 5½x8 in.; paper cover. The Norman W. Henley Co., New York. Price, 25c.

This is a revised and enlarged edition of a booklet which contained a large amount of thoroughly practical information on the subjects named. It is by a man who has had a wide experience along this line and is well worth the price to anyone who has work of this kind to do and is not thoroughly familiar with it.

Wilbur Wright

"He deserves to stand with Fulton, Stephenson and Bell." Such is a part of the statement of President Taft in regard to Wilbur Wright, who died on May 30.

He was born near the town of Millville, Ind., Apr. 16, 1867. His boyhood was spent in Dayton, Ohio, and he was educated in the high schools of that place and of Richmond, Ind.

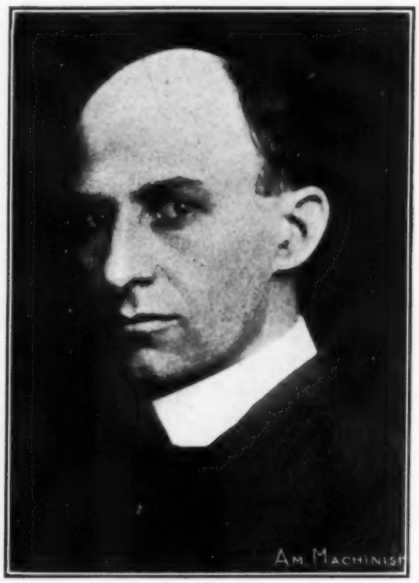
The years of his early manhood were occupied with a small bicycle repair shop, operated with his brother Orville. In this small shop he began the study and experimenting that led to his being the first man to fly in a heavier-than-air machine. When honors finally came to him, he continually shared them with his younger brother, Orville. In regard to himself he was extremely reticent, saying but little more than that he was an aëronaut.

The first flight made by man in an aëroplane was at Kittyhawk, N. C., on Dec. 17, 1903. Orville Wright made the first trial, a jump. Wilbur Wright made the second trial, a jump lasting twelve seconds in a 27-mile wind. He also made the fourth trial of 852 ft. in 52 seconds, this being the first real flight made by man in an aëroplane.

This was the successful working of the greatest mechanical invention of the present generation. In fact, it was even more, for it was undoubtedly the most wonderful achievement of mechanism. The solution of the problem of mechanical flight has been the dream of all mankind, and its attainment was brought about by the genius of Wilbur Wright and his brother.

The success of 1903 was followed by nearly five years of struggle and experimenting, for it was not until the late summer of 1908 that the public began to believe that human flight had been achieved. During this period the public was still skeptical and classed the Wright brothers with the many other makers of flying machines, who had been held up to ridicule. The change came with Wilbur Wright's flights in France, and Orville Wright's flights at about the same time at Fort Meyer, Va.

On May 11, 1908, Wilbur Wright flew 1.85 miles in 2 minutes 28 seconds. This was the first flight observed and reported by newspaper correspondents.



WILBUR WRIGHT

In the summer of this same year he went to France and between August and December made frequent flights that captivated the French people and gave an added stimulus to that interest in aviation which has made the French the leaders of the world in aëronautics. On Aug. 8, at Le Mans, he flew 1 minute 48 seconds; on Aug. 12, four miles, a flight that stirred all France and won him unanimous approval. The passing of the year was celebrated on Dec. 31 by a flight of 2 hours, 20 minutes and 23 seconds, and a distance of 77 miles.

The year 1909 showed other flights with passengers in France and Italy in March, April and May. In the autumn of that year the great Hudson-Fulton celebration was held in New York City. On Oct. 4 he flew from Governor's Island to Grant's Tomb and back, a distance of 21 miles in 33 minutes 33 seconds. Numerous shorter flights were also made, including several around the Statue of Liberty.

That was practically the end of Wilbur Wright's public flying. Thereafter he devoted himself to teaching pupils aviation, and in the course of that work made frequent flights at the training grounds at Dayton. After these pupils had gained proficiency, he ceased exhibition flying altogether, although occasionally going up as a passenger, or privately, for his own pleasure or study.

During the past two years it was his purpose to devote his time and energy to research work to still further perfect heavier-than-air machines, and to discover and declare more of the principles of mechanical flight. Unfortunately this work was seriously interfered with by patent suits in this country, France and Germany. He found little time for constructive work amid the worries of time-consuming patent litigation.

In November, 1909, a corporation with a capitalization of $1,000,000 was formed to build aëroplanes in Dayton under the Wright patents. A plant was constructed and the work is still being carried on there.

Personal

A. C. Vauclain, formerly of Baldwin Locomotive Works, has been appointed general superintendent of the Southwark Machine & Foundry Co., Philadelphia, Penn.

E. H. Webb, master mechanic of the Michigan Central shop at Michigan City, has been transferred to St. Thomas, Ont., to take the place made vacant by the promotion of W. H. Flynn.

Robert W. Rogers has been appointed practical and technical instructor of apprentices, Erie R.R. shops, Port Jervis, N. Y. Mr. Rogers was formerly assistant engineer of tests at the Meadville shops of the Erie.

Alex. McCulloch, formerly superintendent of the De La Vergne Machine Co., New York City, has organized and established the Mechanics Tool and Supply Co., 30 Church St., New York City, of which he is president.

Edwin D. Dreyfus, until recently commercial manager of the Westinghouse Machine Co., East Pittsburgh, Penn., has resigned in order to take up special work with the West Penn Traction and Water Power Co., Pittsburgh, Penn.

J. C. Horne, formerly with the Boston Gear Works, Fellows Gear Shaper Co., and for many years in the gear cutting business, has been appointed treasurer and general manager of the Union Gear & Machine Co., 85 Purchase Street, Boston, Mass.

Edmond D. Bronner has been promoted from superintendent of motive power for the Michigan Central Railway, to the position of general manager, and Walter H. Flynn has been appointed superintendent of motive power, with P. J. Burns as assistant.

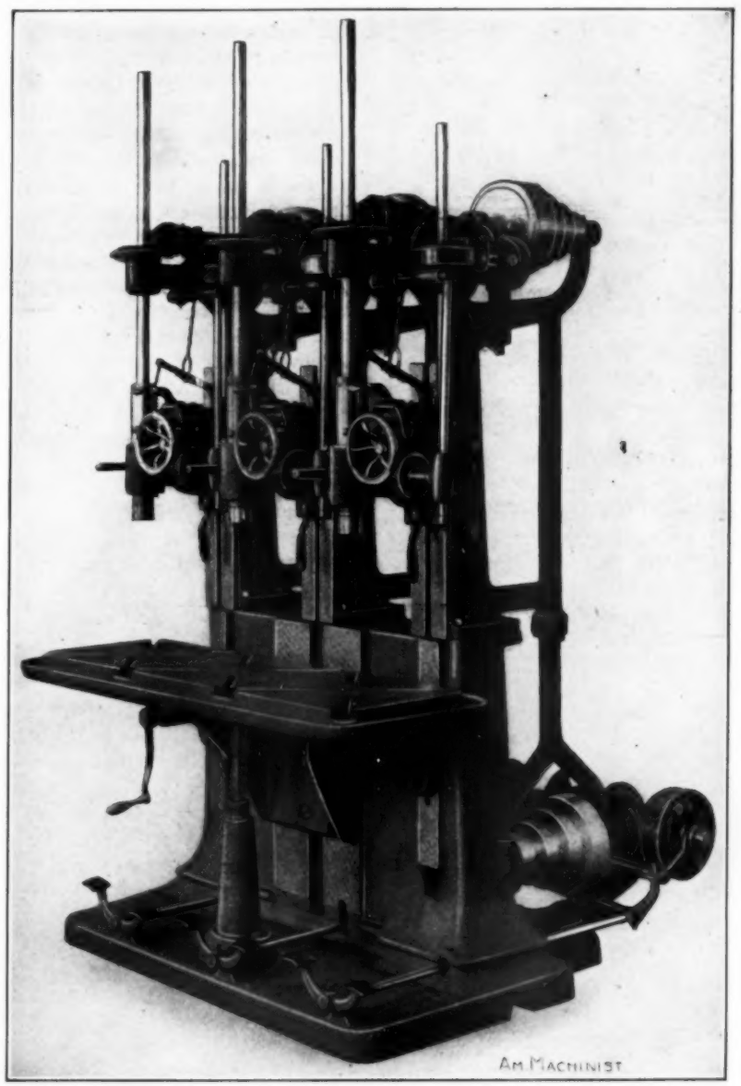
Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

A Multiple Spindle Drilling Machine

The halftone shows a three-spindle 20-in. drilling machine built by the W. F. & John Barnes Co., Rockford, Ill.

These machines are built with from two to six spindles, with back gear, sliding heads, positive self-feed, automatic stop and quick-return lever for the spindle.



MULTIPLE-SPINDLE DRILLING MACHINE

The spindles are 1⅞ in. in diameter, the nose is Morse No. 3 taper. Eight spindle speeds are provided, four of which are through back gears having a ratio of 5½ to 1. The spindles are spaced 15 in. center to center and have a vertical travel of 9 in.

The sliding heads have a traverse of 14½ in. on the column. Each spindle drills to the center of an 18-in. circle. The table of the three-spindle machine has a working surface 14x45 in. and a vertical travel of 12 in. by means of the crank and screw. Each spindle is independent of the other and can be started or stopped without affecting the others.

A geared tapping attachment can be furnished if desired on one or more spindles.

Bench Grinder

The bench grinder shown in the halftone requires little explanation, so far as design and construction are concerned.

As will be noted, the base is designed to keep the machine steady and extends sufficiently to act as a guard for the motor. The tool rest fits around the two sides and face of the wheel, and is adjusted on the base by a bolt.

BENCH GRINDER

The water pot is cast integral with the base in a handy position between the control switch and tool rest. Hard-bronze bearings, adjustable to take up wear, are used.

This grinder is a recent product of the American Electric Tool Co., West Newton, Mass.

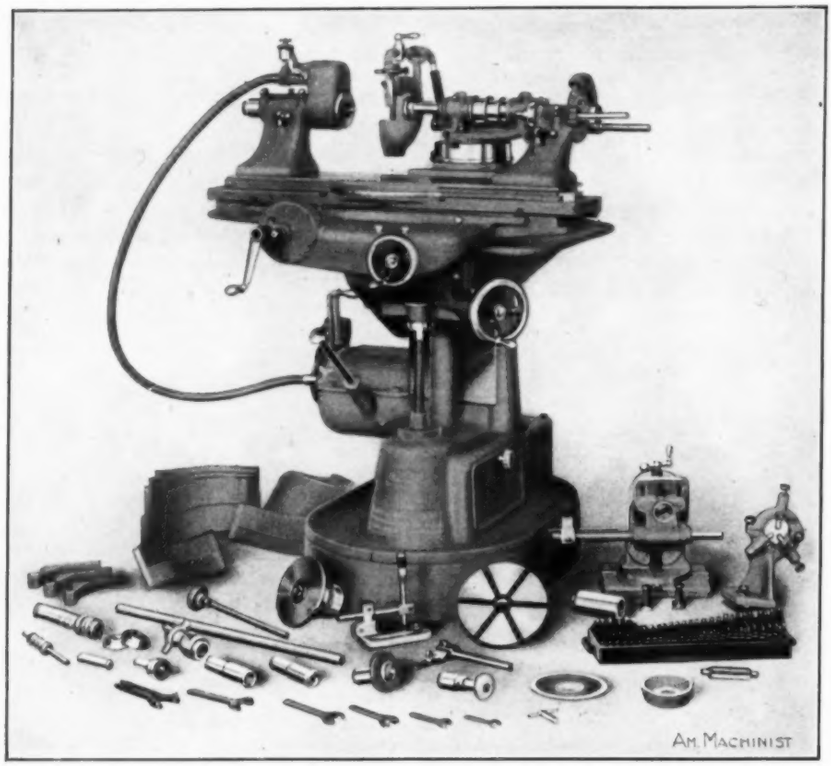
A Universal Grinder

The halftone shows a new universal and tool grinder built by the Brown & Sharpe Manufacturing Co., Providence, R. I. This machine will handle work up to 18 in. in length by 12 in. in diameter, and is intended especially for grinding milling cutters of all kinds, straight and taper reamers, cylindrical and taper work and, with attachments which can be furnished if desired, internal and surface grinding can be accomplished.

The base and column are cast in one piece. The knee is well braced internally. The spindle head has a transverse adjustment of 1½ in., a vertical adjustment of 4 in. and a radial adjustment to any position. The cone has two steps for a 1-in. belt.

The table is operated by a crank and

has a traverse of 26 in., a cross movement of 8 in. and a vertical adjustment of 10½ in. It can be swiveled 45 deg. on either side of zero. A graduated surface is provided to facilitate such setting. Efficient clamps and adjustable stops are provided for the table.



A UNIVERSAL GRINDER

The vertical and cross movements are obtained by conveniently located handwheels, graduated in thousandths. Guards are provided to protect the ways from grit and dirt. Sixteen work speeds from 110 to 530 r.p.m. are obtainable by means of a speed-change mechanism.

Provision is made for wet grinding. The tank is cast around the base and the weight of the water in it tends to lessen vibration. All the movements of the machine are at the front and readily accessible.

Loxograph Triangular Ruler

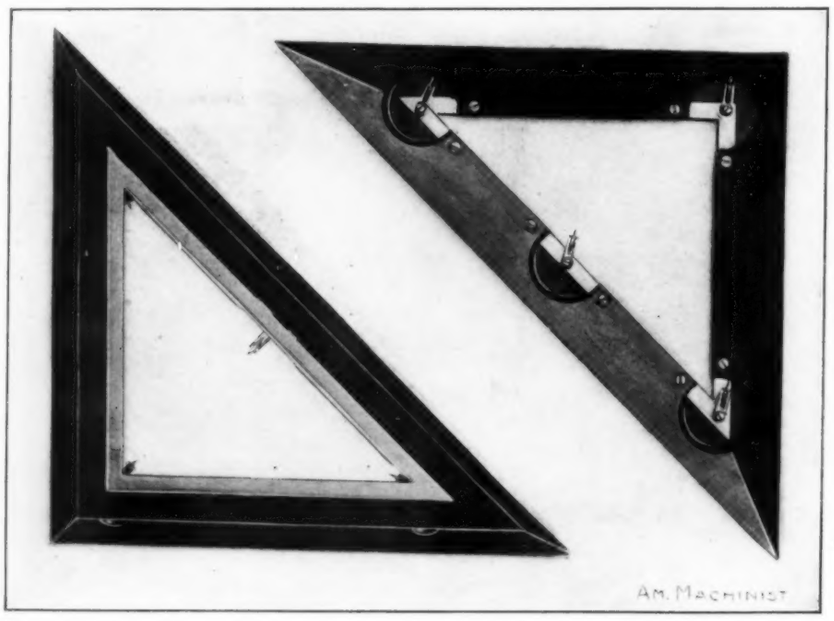
The type of triangular ruler shown in the halftone is designed as a time saver in ink work on the drawing board.

Its object is to enable the draftsman to proceed with the work of making inked line drawings or tracings without waiting for the ink on the lines already drawn to dry. The design of the instrument, as will be noted from the illustrations, is based on the discovery that a properly proportioned knife-edged wheel will run over an ordinary ink line without blurring it, or otherwise smearing the ink. The instrument is, therefore, provided with wheels of this kind, accurately made.

In addition, the ruling edges are held out of contact with the paper, so that not only will they not blur the lines when the instrument is being moved over them, but they are safe against making a smear in case the ink in the drawing pen wets the ruling edges.

The knife-edged rollers permit the instrument to be easily moved around the board in putting in small detail work, and acts as a hand rest. The ruler is held steady by pressing it down on the paper, the degree of steadiness depending upon the degree of pressure.

This instrument is a recent development of the Loxograph Instrument Co., Wilmington, Del.



LOXOGRAPH TRIANGULAR RULER

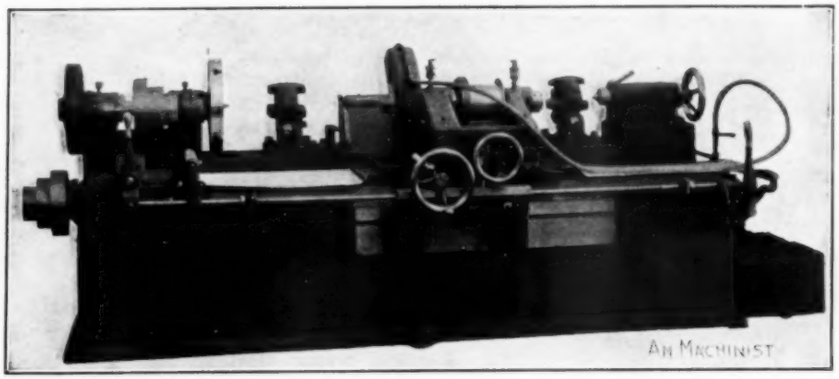
Roll Grinder

This machine was designed for grinding concave rolls by means of a former, which is shown directly under the handwheels. The former is constructed somewhat similar to a taper attachment, so as to have an adjustment. In operation, the intermediate slide on which the wheel head is mounted is forced against the former by means of a heavy spring and the operation of grinding goes on practically automatically, the wheel being fed by means of the small handwheel shown.

The wheel face has a slight curve, which is necessary to reproduce the curve on the former. The two rests shown on each side of the wheel are for revolving the rolls in their own journals, and are adjustable.

The machine is also designed to do internal grinding. The internal attachment is shown in place directly in front of the wheel and is driven by a belt. The pulley over which it runs is a part of the main driving pulley for driving the wheel, and this attachment is removed when the machine is used for either straight or curved grinding.

The machine reverses automatically, as shown by the rod in front, which is equipped with the usual tripping dogs, and this in turn engages with the reversing lever, as shown in the speed box to the left. When this lever is in a neu-



SPRINGFIELD ROLL GRINDER

tral position, and the small lever to the right is impinged against the retaining drum, the mechanism stands idle and the wheel head is traversed forward and back by hand by means of a revolving nut on a stationary screw.

The machine weighs 7250 lb. and has a capacity for grinding rolls 12 in. in diameter by 4½ ft. long. It is equipped with pump and water attachments for wet grinding. The wheel head ways are covered by means of automatic rollers, which wind and unwind as the wheel head traverses back and forth.

This machine is a recent product of the Springfield Manufacturing Co., Bridgeport, Conn.

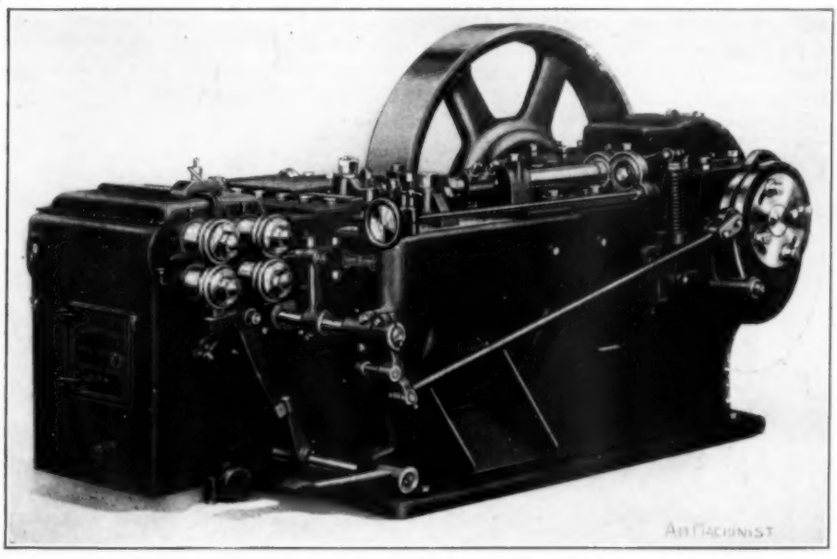
Automatic Feed Rivet Header

The illustration shows a new design of automatic-feed rivet header, recently developed by the National Machinery Co., Tiffin, Ohio.

In this machine, long rods in mill lengths, taken on the initial heat from the finishing rolls or reheated in special long furnaces, are started into the feed rolls by the operator, the rod being advanced automatically, a blank sheared and headed, and a finished bolt or rivet ejected at each revolution of the machine.

A "wedge" gripping mechanism eliminates swollen shanks or fin along the body, and is designed to prevent spring of the dies during the upsetting. The feed rolls are chilled castings and are water jacketed in order to maintain an even temperature and reduce wear on the feeding surface.

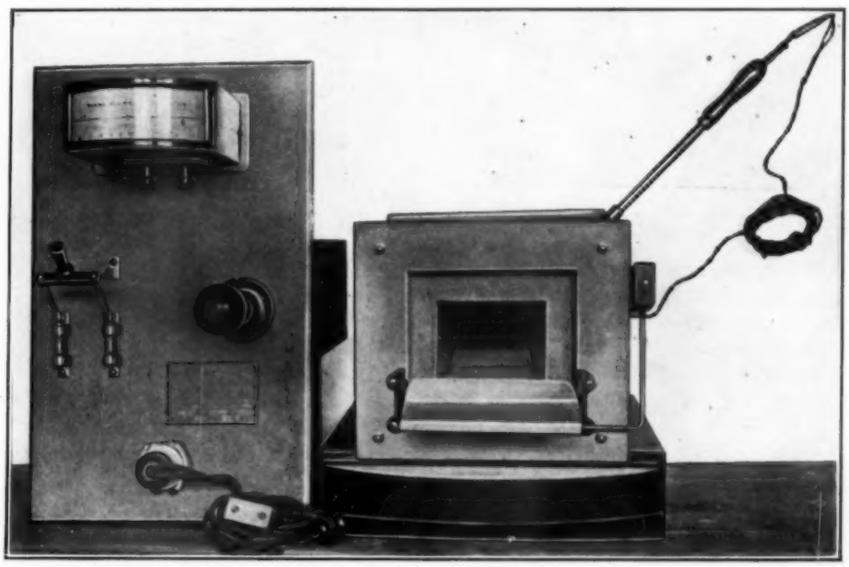
A new type of stock gage is employed, designed to allow rapid and minute adjustment while the machine is in operation, and to eliminate spring. The machine is built in 1-, 1¼- and 1½-in. sizes.



AUTOMATIC-FEED RIVET HEADER

Electric Furnace with Special Controller

The halftone shows an electric muffle furnace, built by the Multiple Unit Electric Co., 136 Liberty St., New York, N. Y. It is provided with a special controller,



ELECTRIC MUFFLE FURNACE WITH SPECIAL CONTROLLER

built directly in the furnace case itself. It can be furnished for either 110 or 220 direct- or alternating-current circuits, but cannot be made to operate on both of the circuits, as the controller is built especially for a particular voltage, which must always be specified.

With this furnace, temperatures from 200 to 1800 deg. F. can be maintained indefinitely. When it is desired to merely keep the furnace hot but considerably below the maximum temperature, the controller handle can be moved to mid position, and a temperature of 1000 deg. can be maintained in the furnace till the higher temperature is desired, which can be obtained in a very few moments by moving the handle to the extreme right.

The switchboard to the left carries the usual switch and socket, a red lamp to show when the furnace is working, and at the top a Thwing pyrometer.

A Materials Testing Machine

A simple materials testing machine, designed to meet the needs of machine shops, has been put on the market by the firm of Donauwerk Ernst Krause & Co., Vienna, Austria.

It is adapted for tension, compression, shearing and hardness tests, the latter by the Brinell method. Fig. 1 shows the machine set up for a tension test with an extensometer in place on the test specimen. Fig. 2 shows the setup for a compression test. Another device, not illustrated, adapts the machine for the investigation of shearing resistance.

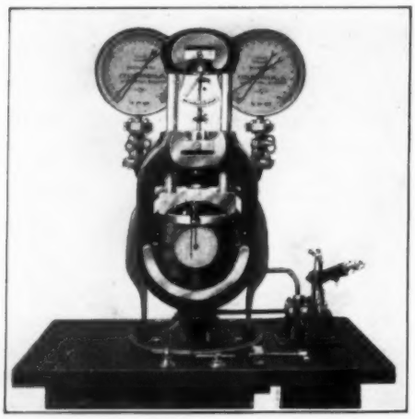


FIG. 1. SET UP FOR TENSION TEST

The machine consists of a hydraulic press, roughly spherical in shape, operated by fluid from a small hydraulic hand pump, shown at the right in Figs. 1 and 2. A number of rings, or elongated yokes, are provided. These take the reaction of the stress upon the specimen under test. Connected into the hydraulic system are two precision pressure gages, as shown in the illustration. Pressures are read directly from these gages, the one at the right having a capacity up to 10,000 kg. (22,000 lb.), the other up to 50,000 kg. (110,000 lb.).

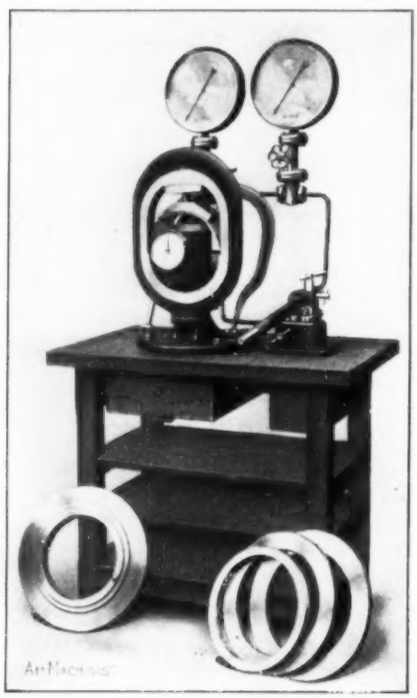


FIG. 2. SET-UP FOR COMPRESSION TEST

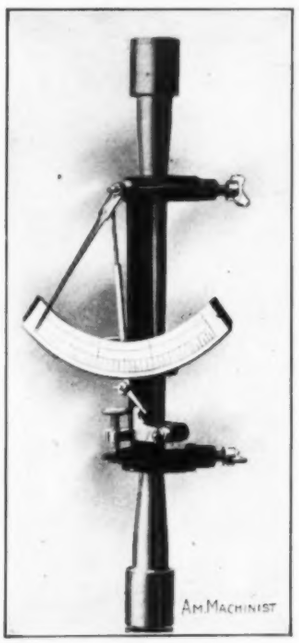


FIG. 3. INDICATING EXTENSOMETER

At the beginning of a test, both pressure gages indicate together. If the pressure reaches 10,000 kg., the lower reading gage is cut off by means of a valve and the other continues to indicate.

The arrangement for making tensile tests, shown in Fig. 1, consists of an elongated yoke, having two rods passing through its upper end and connected into a straining head. Another straining head is let into the upper end of the yoke, opposed to the straining head carried by the rods. The hydraulic press is placed within the yoke and upon its upper hemispherical surface is fitted a crosshead, to which is fixed the lower end of the rods.

The specimen to be tested is put in place between the straining heads. Fastened thereto is an indexing extensometer, as shown in place in Fig. 1, and in detail in Fig. 3. As pressure is applied to the system, the piston of the press is forced upward, thereby tending to separate the straining heads, and putting stress upon the specimen.

Figs. 4 and 5 show two methods of holding the ends of specimens for tensile tests. Details of the device for compression tests are much simpler, and are closely shown in Fig. 2.

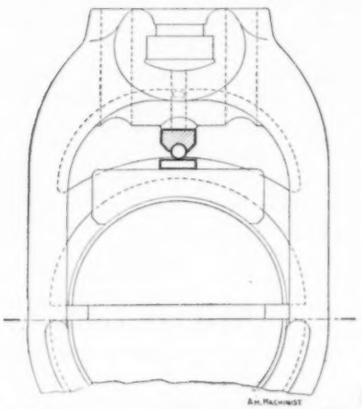


FIG. 6. DEVICE FOR BRINELL BALL TEST

The special compression device for the Brinell hardness test is shown in Fig. 6. This consists of a holder for the hardened-steel ball, which is forced into the test specimen. The relative arrangement of the parts is clearly shown.

This machine has been developed for situations where a great degree of refinement in observations is unnecessary, as in the ordinary testing of materials in the machine shop. For much work of this nature, extremely precise results are unnecessary. This device, properly handled, will give final results within 2 per cent., either way, of more correct values which might be obtained with highly refined apparatus.

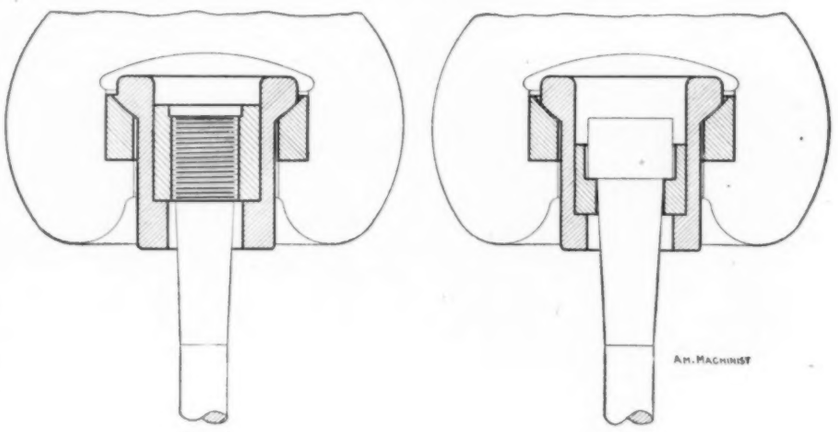


FIG. 4 FIG. 5

TWO METHODS OF HOLDING TEST SPECIMENS

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

S. E. Pope, Jeffersonville, Vt., is contemplating the erection of a large garage, near the opera house.

R. S. Gorham will erect a two-story garage, 133x46 ft., on Brattle St., Cambridge, Mass.

The Griffin Wheel Co., Chelsea, Mass., will erect a one-story machine shop, 80x100 ft.

Plans have been approved by White & Durgin, Haverhill, Mass., for the construction of a large fireproof garage on Main St.

The Randall-Faichney Co., Jamaica Plain, Mass., manufacturers of automobile accessories, will erect a new four-story and basement plant, 60x250 ft. The firm's present address is 51 Causeway St., Boston, Mass.

The J. N. Lapointe Co., Marlboro, Mass., manufacturers broaching machines and tools, will erect a new two-story factory, 48x132 ft., and a two-story extension 22x50 ft., in New London, Conn. Dudley St. C. Donnelly, New London, Conn., is the architect.

The United Printing Machinery Co., Norwood, Mass., has awarded the contract for the construction of a factory at Broadway and East Hoyle St.

The Buick Garage, Centre St., Northampton, Mass., is being enlarged by the addition of wings on either side. An electric elevator is also to be installed.

The Baush Machine Tool Co., Springfield, Mass., will build a steel and concrete plant, 300x100 ft., for the making of castings for machinery, which will be located at Chicopee, Mass.

The Turner & Seymour Mfg. Co., Torrington, Conn., manufacturer of brass goods, will erect an addition, 42x64 ft., two-story and basement, to its plant.

The Worcester Pressed Steel Co., Worcester, Mass., will erect two additions to its plant, one 100x100 ft., for rolling department, the other 108x66 ft., for pickling department.

Charles H. Hildreth, Worcester, Mass., will erect a 60x150-ft. modern garage, at 6 Sever St. Plans are being prepared.

Congdon & Deslauriers, Bristol, R. I., are erecting a public garage, on Hope St.

The Kendall Garage, on Broad St., Providence, R. I., was burned, May 26. Loss, $25,000.

The Gaynor-Mitchell Co., manufacturers of brass novelties, Bridgeport, Conn., has awarded the contract for the construction of a new plant. The structure will be 60x146 ft., of brick.

The Bristol Brass Co., Bristol, Conn., is considering plans for the construction of an addition to its rolling mill, in East Bristol.

The Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn., is having plans prepared for the construction of an addition to its factory.

The Mystic Automobile Station, New London, Conn., will build a two-story addition to its present building.

Plans are being prepared for the construction of a new machine shop, at Bank and Meadow Sts., Waterbury, Conn., for the Waterbury Farrel Foundry & Machine Co. It will be 60x180 ft., one story high.

Griggs & Hunt, architects, Waterbury, Conn., have prepared plans for the construction of a new factory on the Watertown Road, for the Pilling Brass Co. It will be of brick, 50x110 ft., one story high.

MIDDLE ATLANTIC

A one-story addition is to be built to the plant of the Frontier Iron Works, at Letchworth St. and the New York Central R.R., Buffalo, N. Y.

The core room at the plant of the Buffalo Forge Co., 460 Spring St., Buffalo, N. Y., was damaged by fire, May 22. Loss, $500.

The garage and store house of William H. Lee, at 108 Brayton St., Buffalo, N. Y., was totally destroyed by fire, May 23.

A garage, at 1447 49th St., Brooklyn, N. Y., owned by Mary Opal, was damaged by fire, May 27. Loss, $600.

N. A. Stevens, 62 Temple St., Elmira, N. Y., will erect a one-story garage, 40x60 ft.

The Alberger Condenser & Pump Co., Newburgh, N. Y., will enlarge its plant.

The contract has been awarded by the United States Light & Heating Co., Niagara Falls, N. Y., for the building of an addition, 320x56 ft., to its plant, to provide space for the manufacture of automobile starting devices.

The Oneida Foundry Co., Oneida, N. Y., which is building a new plant for the manufacture of gray-iron castings, will install the following equipment: One hydraulic elevator, for delivering material to the charging floor; one gravity machine; two jar rammers, and one squeezer for molding department; two tumbling barrels and one cinder mill; also equipment for a small machine shop.

T. F. Smith will erect a two-story garage at 540 Monroe Ave., Rochester, N. Y.

John Hannan, Schenectady, N. Y., contemplates the erection of a garage on the site of the Newell Block, on State St., which was destroyed by fire. The new building is to have a frontage of 66 ft. on State St., and a depth of 200 ft.

It is reported that the Dyneto Electric Co., manufacturer of lighting devices for automobiles and motor boats, will remove its plant from Elbridge to Syracuse, N. Y.

The contract for the construction of a three-story and basement addition to the plant of the Savage Arms Works, Utica, N. Y., has been awarded. R. A. George is the architect. Estimated cost is $20,000.

The Hartford Suspension Co., manufacturer of automobile parts, Jersey City, N. J., have awarded the contract for the construction of a new reinforced-concrete building. It will be erected on Morgan St., and will be six stories high, 75x127 ft.

M. J. Peck will erect a two-story iron foundry, 35x75 ft., at Newark, N. J. Estimated cost, $4000.

The contract for the construction of an additional factory building to the plant of the Pennsylvania General Electric Co., Erie, Penn., has been awarded. It will be 400x365 ft., and of reinforced concrete.

The Pittsburgh Steel Co., Monessen, Penn., has increased its capital from $14,000,000 to $17,500,000, and will enlarge and improve its plant.

The Sheeler, Hemsher Co., Philadelphia, Penn., will erect an iron foundry, 26x124 ft.

The Philadelphia Electric Co., Philadelphia, Penn., will erect a garage, 30x54 ft., to cost $5000.

The Pennsylvania Galvanizing Co., Philadelphia, Penn., is erecting a garage and storage building, 100x132 ft., at 22nd and Race Sts., at a cost of $12,000.

Armstrong & Latta, Land Title Bldg., Philadelphia, Penn., have received a permit to convert the stables of the Adams Express Co., Philadelphia, into a garage, at an estimated cost of $27,000.

The Parkesburg Iron Co., Parkesburg, Penn., will build an addition to its tube mill. The building will be one story, of steel and corrugated iron, 80x175 ft. H. A. Beale, Jr., is president.

The American Can Co., Maryland Trust Bldg., Baltimore, Md., will build a two-story factory at its plant at Hudson and Boston Sts.

Bids will be received as follows until 10 a.m., June 18, by the Paymaster-General, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., on the following materials: Schedule 4584, Class 35, for delivery at Boston and Philadelphia Navy Yards, 43,200 lb., navy type, cast steel; Class 36, for delivery at Boston Navy Yard, 62,000 lb. crucible cast-steel galvanized wire; Class 37, for delivery at Brooklyn Navy Yard, a large quantity of files, various types; the balance of the circular calls for smaller quantities of hinges, galvanized-iron paint pots, brass escutcheon pins, solder, hose, etc.; Schedule 4586, Class 61, for delivery at Norfolk, Va., 18,850 lb. steel angle bars; Class 62, for delivery at same yard, 24 point switches; Class 63, for delivery at same yard, 10.8 75-lb. rails and 2600 lb. fish plates; Schedule 4587, Class 71, for delivery at Newport, R. I., 305 manganese bronze forgings, for main shafts, propeller shafts and crossheads; Class 72, for delivery at same yard; six torpedo bronze forgings for bevel gears; Class 73, for delivery at same yard, 1025 mild-steel forgings for propeller shafts, cranks and pistons; Class 74, for delivery at Washington Navy Yard, 5000 ft. 6-in. galvanized-iron pipe for water; Schedule 4588, for delivery at various yards, Classes 81 to 94, single conductor wire, brass bolts and nuts, composition stud bolts, steel bolts and nuts, steam gages, hose, rolled naval bronze, hard drawn brass, copper tubing and pipe, gate valves for steamship "New York"; schedule 4599, for delivery at Washington Navy Yard, Class 181, one double-end, 600-volt, direct-current electric locomotive for standard-gage track; Class 182, four gondola cars of 60,000 lb. capacity each, 30 ft. long, 8 ft. 2 in. wide; Class 183, two electrically driven centrifugal machines, driven by a 60-cycle, 3-phase, 220-volt, fully inclosed motor, and provided with a 40-in. diameter steel perforated basket, 18 in. deep; Class 184, one hydraulic finishing press for powder; Class 185, one duplex steam cross-compound air, steam actuated air compressor, designed for delivery of air pressures of from 100 to 110 lb., to displace about 1175 cu.ft. free air per minute at 120 r.p.m., with steam pressure of 125 lb., floor space 8x15½ ft.; weight, 30,500 lb.; Class 186, one vertical feed-water heater of closed type, designed for heating boiler feed water with exhaust steam.

SOUTHERN STATES

The Smith Construction Co. has been awarded the contract to build a garage at the corner of Chestnut and Kirk Sts., Morgantown, W. Va., which is to be completed in 90 days.

The City Garage & Sales Co., Augustine, Fla., will erect a garage and machine shop at Cedar and Cordova Sts.

The National Mfg. & Plating Co., 133 North Third St., Louisville, Ky., has established a brass and plating plant and will manufacture gas fixtures and other specialties.

MIDDLE WEST

The Pfahl Gauge & Mfg. Co., Akron, Ohio, capitalized for $30,000, will build and equip a factory, 50x165 ft., to manufacture a new gage for automobile gasoline tanks. F. L. Pfahl is the president.

The Buckeye Twist Drill Co., Alliance, Ohio, is completing its plant and will install the machinery soon.

The Lincoln Electric Co., Cleveland, Ohio, is erecting a new factory, at Kelly Ave. and East Thirty-eighth St.

Lucas & Christensen, of Cleveland, Ohio, garage owners, are erecting a new garage at 2150 East Eighteenth St.

The Standard Worm & Gear Co., Cleveland, Ohio, organized with $100,000 capital, by F. M. Gregg and A. T. Hills, to build a large factory to manufacture gears of all kinds.

I. A. Zangule, Cleveland, Ohio, will erect a one-story garage, 70x70 ft. F. Baird is the architect.

A large new factory will be built and equipped by the Lincoln Electric Co., Cleveland, Ohio, to manufacture electrical lighting and other miscellaneous equipment.

The Pennsylvania R.R., Cleveland, Ohio, will build a new two-story machine shop, 65x70 ft., of steel. Complete machine-shop equipment will be purchased.

The Euclid Boulevard Co., Cleveland, Ohio, will erect a garage.

A large commercial garage will be built by the Lucas & Christenson Co., at 2150 East Eighteenth St., Cleveland, Ohio.

The Winton Motor Car Co., Cleveland, Ohio, will add a new building to its plant.

Bardons & Oliver Co., Cleveland, Ohio, maker of lathes, screw machines, etc., will build an addition to its plant, to cost $90,000. Considerable machine-shop equipment will soon be purchased.

The P. A. Geier Co., 5112 St. Clair Ave., Cleveland, Ohio, makers of automobile parts and small machine parts, will add a new building to factory and buy new machine tools.

A building on Euclid Ave., near East 19th St., Cleveland, Ohio, was damaged by fire, May 27. The losses were as follows: Jackson Motor Car Co., $30,000; Firestone Tire Co., $75,000; Grabowsky Power Wagon Co., $10,000.

George C. Schneider, Cleveland, Ohio, will erect a garage. E. E. Smith is the architect.

The Oakley Park Co., Cincinnati, Ohio, will erect a garage at Elberon and Eighth Aves.

The Allyn Engineering Co., of Cincinnati, Ohio, has been commissioned to draw the plans for the factory buildings for the American Well & Prospecting Co., which will come to Columbus, Ohio, from Corsicana, Tex.

The Standard Malleable Iron Co., Columbus, Ohio, incorporated for $10,000 by F. A. Miller, William Deeds and others, to equip a plant to make malleable iron castings.

The Hall Real Estate Co., East Liverpool, Ohio, has broken ground for the construction of the new Standard Garage, at East Fifth St. and Broadway, to cost about $6000.

The Willys-Overland Co., Toledo, Ohio, automobile manufacturer, has awarded contracts for the erection of a three-story reinforced concrete building, 92x162 ft., and two one-story buildings to cost $30,000.

The Nyberg Automobile Co., Second and Sycamore Sts., Anderson, Ind., will erect a one-story factory, 90x180 ft. Noted May 2.

The Kokomo Stove & Range Co., Kokomo, Ind., has awarded the contracts for two factory buildings, each 60x80 ft.

Dr. C. A. Dresch, Mishawaka, Ind., has been granted a permit for the construction of a brick garage in the rear of his residence on South Mill St.

The Chamberlain Metal Window Strip Co., whose plant at Detroit, Mich., was damaged by fire, will erect a new factory at Peru, Ill.

E. O. Inland has let the contract for a garage at South Bend, Ind.

Vincent Corbett, 65 Home Bank Building, Detroit, Mich., will erect a one-story garage, 22x25 ft.

The contracts for the construction of a two-story factory, 190x65 ft., for the McCord Mfg. Co., Detroit, Mich., manufacturer of automobile parts, have been awarded. The estimated cost is $40,000. Albert Kahn and E. Wilby, Trussed Concrete Building, Detroit, are the architects.

The Wilson Body Co., Clay Ave., Detroit, Mich., is having plans prepared for a two-story and basement factory, 185x85 ft. The estimated cost is $35,000. Smith, Hinchman & Grylls, 710 Washington Arcade Building, are the architects.

R. C. Hupp and L. G. Hupp, of Detroit, Mich., have purchased 900 ft. of land, on Lycaste Ave., which adjoins the present R. C. H. plant. It will be used for a large addition to the R. C. H. plant.

The Pattern Works, Detroit, Mich., is having plans prepared for a new factory building.

Henry Smith, Grand Rapids, Mich., has received a permit to erect a two-story brick garage on Ottawa Ave., at a cost of $8000.

The Argo Electric Vehicle Co., South Jefferson Ave., Saginaw, Mich., announces that work will be started immediately on the construction of a new three-story and basement factory addition, 120x120 ft., to cost $50,000.

The Larson Ice Machine Co., 179 North Jefferson St., Chicago, Ill., will erect a two-story ice-machine factory.

H. McFarland will erect a garage at 531 Harrison St., Chicago, Ill.

The Garden City Spring Works, Chicago, Ill., will erect a one- and two-story forge and machine shop, 175x100 ft.

The Oliver Estate will erect a four-story garage, 60x125 ft., at Chicago, Ill.

The Selig Polyscope Co., Chicago, Ill., will erect a factory, 40x124 ft., to cost $20,000.

N. B. Starks will erect a two-story garage at 827 Castlewood Terrace, Chicago, Ill., to cost $5500.

Oscar F. Meyer, Chicago, Ill., will erect a four-story garage, 50x109 ft.

Charles H. Besly & Co., Beloit, Wis., manufacturers of brass goods, are planning the erection of a large addition to their plant. It will be a three-story structure, 260x70 ft., and will be built of concrete.

The National Brake & Electric Co., Bellevue Place and North Cambridge Ave., Milwaukee, Wis., is having plans prepared for a one-story foundry, 240x120 ft. H. J. Esser, 426 Camp Building, is the architect.

The Universal Motor Truck Co., Milwaukee, Wis., will erect a large plant, at Milwaukee.

Eugene St. Peter, Marinette, Wis., has purchased a building on West Front St., which he is remodeling into a garage.

The Holbrook-Armstrong Co., Racine, Wis., will erect a large building to manufacture various kinds of machinery.

P. V. O. Van Vechten and K. J. Reams will erect a large garage and repair shop at Third and McIndoe Sts., Waupun, Wis.

WEST OF THE MISSISSIPPI

The Dows Auto Co., Dows, Iowa, has started the erection of a new garage on North Garfield St.

Bids are being received by J. Oliver Hogg, New York Life Bldg., Kansas City, Mo., for the construction of a two-story factory, 75x150 ft., for the Lubben-Boler Vacuum Co., Beatrice, Neb., to be erected at Kansas City.

The secretary of the Mississippi Commission, 1307 Liggett Building, St. Louis, Mo., will soon receive bids for the fabricated structural-steel framing for a shop building, 70x160 ft., with truss roof.

The Braslin Boiler Works, Fort Smith, Ark., will erect a foundry, 130x140 ft. The estimated cost is $65,000.

The factory of the McGregor Machine & Auto Co., McGregor, Tex., was totally destroyed by fire, May 23.

WESTERN STATES

Reid Bros., Bellingham, Wash., boiler makers and engineers, are planning to build a boiler factory, at North Bellingham.

The contract has been awarded for the construction of a three-story brick and steel garage, on Pike St. and Broadway, Seattle, Wash., for the Lozier Motor Car Co. The estimated cost is $35,000. Noted May 9.

The Fox Gas Engine Co., Astoria, Ore., has acquired a site on the Duwamish waterway, Seattle, Wash., and will erect a gas-engine works.

H. O. Harrison & Co., Los Angeles, Calif., has started the erection of a concrete garage. The estimated cost is $90,000. Noted Mar. 21.

Wickland & Britton, San José, Calif., are erecting a building to be used as a machine shop, automobile repair shop and to manufacture pneumatic jacks for automobile use.

McDonald Purcell and George Seeley, Venice, Calif., have purchased the Midway garage, at Venice, Calif., and will erect a large addition. Machinery to cost about $16,000 will be installed.

CANADA

The Whitman & Barnes Mfg. Co., St. Catherines, Ont., manufacturer of hardware, will erect two additional buildings to its plant. The smaller will be an addition to the present building and will be used as a forge shop. The larger will be one story high, 100x30 ft., and will run parallel with the other buildings. The estimated cost is $35,000.

The Sanitary Can Co., Niagara Falls, Ont., has purchased two additional lots adjoining its plant and is planning to erect additional buildings. The estimated cost is $60,000.

The Galt Malleable Iron Co., Galt, Ont., will increase the capacity of its plant.

The Baker Motor Vehicle Co., Cleveland, Ohio, makers of the Baker Electric cars, will erect a large new factory, at Toronto, Ont.

New Incorporations

METAL WORKING

The following companies have been incorporated to manufacture:

The Flather Planer & Shaper Co., Lowell, Mass.; tools. Capital, $30,000. Incorporators, F. E. Dunbar and J. J. Rogers, Lowell.

The Iron Co., Hartford, Conn.; iron and metal goods of all kinds. Capital, $267,650. Incorporators: H. R. VonWessley, E. M. Spencer and D. M. Scott, all of Hartford.

The East New York Motor Cab Co., Brooklyn, N. Y.; automobiles. Capital, $5000. Incorporators: Jacob Rauch and Francis Rauch, 73 Hendrix St., and Dan Barnet, 56 Jamaica Ave., Brooklyn.

The New Metal Bed Co., Brooklyn, N. Y.; metal and iron wares. Capital, $2000. Incorporators: Abe. Levine, 112 Madison St., Sall Katz, 551 First St., and Aaron Mazer, 162 Chester St., Brooklyn, N. Y.

The Remson Automobile Co., Brooklyn, N. Y.; motors and machinery. Capital, $5000. Incorporators: Andrew F. Wilson, 629 Jefferson Ave., William Konwenhoven, 2 Remson Pl., and Albert J. Atchison, 517 St. Marks Ave., Brooklyn.

The Holder Welding Equipment Co., Brooklyn, N. Y.; welding machinery. Capital, $25,000. Incorporators: Charles Holder, Jr., 22 Emmett St., Brooklyn, and Solomon Heller and David E. Heller, 248 East Northampton St., Wilkes-Barre, Penn.

The Service Recorder Co., Boro. Manhattan, N. Y.; recording machines. Capital, $10,000. Incorporators: Frederick Seymour, 55 Prospect St., East Orange, N. J.; Benjamin N. Levy, 82 Washington Pl., New York, N. Y., and Harold F. Seymour, 1923 East 90th St., Cleveland, Ohio.

The Vacuum Massager Mfg. Co., Boro. Manhattan, N. Y.; vacuum massage machine. Capital, $10,000. Incorporators: F. C. Howe, 31 Broadway, V. C. Bogardus and A. L. Friedberg, 150 Nassau St., New York, N. Y.

The Magee Supply Co., Boro. Manhattan, N. Y.; machinery and supplies. Capital, $10,000. Incorporators: Charles A. Allen, 114 Liberty St., Alonzo H. Magee, 106 Beekman St., and Charles E. Francis, 92 William St., New York, N. Y.

The Frevert Machinery Co., 38 Vesey St., Boro. Manhattan, N. Y.; machine tools. Capital, $30,000. Incorporators: Hubert Dalton, Jay N. Enley and Clarence E. Mundy, 15 William St., New York, N. Y.

The Whitney Refrigeration Co., Boro. Manhattan, N. Y.; refrigerating machinery. Capital, $40,000. Incorporators, A. D. Stanton, F. W. Bailey, New York, N. Y., and E. L. Keener, Brooklyn, N. Y.

The Oil Furnace & Engineering Co., Boro. Manhattan, N. Y.; oil-burning engines. Capital, $100,000. Incorporators, R. B. Floyd-Jones and F. Floyd-Jones, New York, N. Y., and H. F. E. Gramm, Rutherford, N. J.

The Electric Flasher Co., Boro. Manhattan, N. Y.; electric flashers for advertising. Capital, $25,000. Incorporators, R. A. Witthaus, C. Tatham and E. Conway, New York, N. Y.

The Grieve Grate Co., Boro. Manhattan, N. Y.; grates and furnaces. Capital, $1,150,000. Incorporators, G. F. Learnard, W. Kutzleb and H. F. McNamara, New York, N. Y.

The Pearson Reciprocity Motor Co., Boro. Manhattan, N. Y.; machinery. Capital, $100,000. Incorporators, C. P. Pearson, C. L. Herrington, Brooklyn, N. Y., and J. A. McCarren, New York, N. Y.

The United Electric Supply Co., Boro. Manhattan, N. Y.; mechanical and electrical appliances. Capital, $100,000. Incorporators, A. P. Anderson, O. B. Fraser and J. G. Clarke, New York, N. Y.

The Dieter Nut Co., Boro. Manhattan, N. Y.; mechanical appliances. Capital, $100,000. Incorporators, P. W. Dieter, Buffalo, N. Y.; H. H. Lamson and F. P. Reese, New York, N. Y.

The Foreign Tool & Machinery Co., Boro. Manhattan, N. Y.; tools and machinery. Capital, $5000. Incorporators: Katherine A. Woods, 373 6th Ave., and Margaret Sander, 226 Ridgewood Ave., Brooklyn, N. Y., and Elvira Selmer, Hamilton Park, S. I., N. Y.

The Gas Engine Self Starting Co., Boro. Manhattan, N. Y.; engine appliances. Capital, $1000. Incorporators: George M. Auten, 267 Lenox Road, and Harry C. Farnum, 411 55th St., Brooklyn, and Samuel C. Altemus, Germantown, Philadelphia, Penn.

The H. & M. Hirschberg Co., Owego, N. Y.; lighting fixtures. Capital, $25,000. Incorporators, W. Huck, Jr., A. W. Dalton and J. Gerradt, New York, N. Y.

The National Automatic Sales Co., 419 Market St., Camden, N. J.; vending machines. Capital, $300,000. Incorporators, Edward Rick, Alton H. Bowman and Lawrence Rupp.

The Rectigraph Co. of New Jersey, Jersey City, N. J.; rectigraph machines and mechanical photographers. Capital, $15,000. Incorporators: A. F. Garbe, 400 East 141st St., New York, N. Y.; C. A. Cole, Hackensack, N. J., and R. A. VanVoorhie, 15 Exchange Pl., Jersey City, N. J.

The Hewitt Bearing Metal Co., 784 Broad St., Newark, N. J.; castings, bearings and packings. Capital, $30,000. Incorporators, James Hewitt, Edgar A. Morse and Christian Franz.

The McMyler Interstate Mfg. Co., Cleveland, Ohio; structural iron and steel bridges and bridge materials, castings, engines and boilers. Capital, $5000. Incorporators, E. R. Fancher, John M. Watson and B. E. Robertson.

The National Carbon Co., Cleveland, Ohio; tank cars for transporting oils. Capital, $10,000. Incorporators, Ellis R. Diehm, H. J. Crawford and Donald McBride.

The J. R. Wood Supply Co., Cincinnati, Ohio; mill, mine and foundry supplies. Capital, $15,000. Incorporators: J. R. Wood, Carl C. Port and D. G. Wiley.

The Cement Products Machinery Co., Columbus, Ohio; cement-making machinery. Capital, $50,000. Incorporators: Walter E. Felton, C. C. Flarida and William H. Sharp.

The Burkett Agricultural Works Co., Columbus, Ohio; manufacturing and repairing farming machinery. Capital, $20,000. Incorporators: John Burkett, Harry Lowrie and G. H. Robinson.

The Illinois Electric Motor Mfg. Co., Chicago, Ill.; electrical motors and apparatus. Capital, $5000. Incorporators, Abe F. Richman, Edgar E. Benedict and James R. Semple, 315 East Sixtieth St., Chicago.

The Chicago Safety Match Co., Chicago, Ill.; coin controlled vending machines. Capital, $10,000. Incorporators, John S. Lord, R. D. Stevenson and Albert L. Hopkins.

General Manufacturing

NEW ENGLAND STATES

The National Shoemaker mill No. 2, Auburn, Maine, which has been closed for several months, has been purchased by the Field Bros. & Gross, of Auburn, who will start it again and manufacture 4000 pairs of shoes daily.

The Knox Woolen Co., of Camden, Maine, will build a large addition to its factory and is having plans drawn.

The Corinna Mfg. Co., Corinna, Maine, has recently been incorporated and will build a plant for the manufacture of woolen goods. J. H. Winchester is president.

Fire, on May 25, caused a loss of $300,000 to the Androscoggin Pulp & Paper Co., at South Wyndham, Maine. Loss, $175,000; stock, $125,000; covered by insurance.

The F. A. Whitney Carriage Co., Leominster, Mass., will erect an addition to its two-story factory, 40x90 ft. The plans are being drawn by William D. Thompson, State Mutual Building, Worcester, Mass.

Fire destroyed the sand-sifting plant of the Dunn & McCarthy Co., North Wilbraham, Mass., causing a loss of $25,000. Considerable machinery was destroyed.

The Eaton, Crane & Pike Co., manufacturers of stationery, Pittsfield, Mass., have awarded the contract for the construction of an addition. It will be two stories high, costing $30,000.

The leather factory of Franklin Haddock, at 12 South Mason St., Salem, Mass., was destroyed by fire, May 23. Loss, $10,000.

The Uxbridge Worsted Co., Uxbridge, Mass., has awarded the contract for the erection of two new buildings to E. D. Ward, 82 Foster St., Worcester, Mass. one of these buildings will be three stories, 65x67 ft., and the other one story, 50x70 ft., of mill construction.

The Massachusetts State Hospital at Westboro, Mass., will erect a new heat, light and power plant, to cost $50,000.

One of the buildings of the United Cork & Seal Co., Willis, Mass., was damaged by fire, May 28. Loss, $75,000.

The National India Rubber Co., Bristol, R. I., is to erect a new building, 200x40 ft.

William D. Sowter, formerly superintendent of the Phenix Lace Mill, will erect a new lace mill, at Carolina, R. I.

Pratt-Read & Co., Deep River, Conn., manufacturers of ivory piano keys, will erect a two-story addition to its factory.

The Nashawang Electric Power Co., Danielson, Conn., will install a new 500-kw. generator and new turbine for generating 800 hp., at its plant at Plainfield, Conn.

The Warren Woolen Co., Stafford Springs, Conn., has awarded the contract for the construction of a two-story addition, 136x53 ft., to its factory. It will be of brick.

The Diamond Bottling Corporation, Waterbury, Conn., has awarded a contract for the construction of an addition on South Main St. It will be two stories high, 28x50 ft., of brick.

MIDDLE ATLANTIC STATES

Julius Kayser & Co., manufacturers of silk hosiery, with headquarters in Brooklyn, N. Y., will build a boiler house three stories in height in connection with their silk mills at Amsterdam, N. Y., to contain two 150-hp. boilers. The concern will also build an addition to its mill three stories in height and 120 ft. long.

The Industrial Co., Binghamton, N. Y., has filed a certificate of increase of capital stock of from $80,000 to $125,000 for the purpose of building additions to the shoe factory of Dunn & McCarthy.

The factory of the Atlas Embroidery Works, 185 Van Brunt St., Brooklyn, N. Y., was damaged by fire, May 27. Loss, $15,000.

Valentine & Co., manufacturers of varnishes, 364 Manhattan Ave., Brooklyn, N. Y., have awarded a contract for the construction of a reinforced-concrete oil building. It will be two stories high, 64x33 ft.

The cooperage of Joseph Dalton, 102 Berry St., Brooklyn, N. Y., was damaged by fire, May 26. Loss, $15,000, partly covered by insurance.

The plant of the Valvoline Oil Co., at the foot of Maspeth Ave., Brooklyn, N. Y., was destroyed by fire, May 24. Loss, $30,000.

Fire damaged the plant of the Connolly Cooperage Works, Brooklyn, N. Y., on May 24. Loss, $25,000.

The plant of the Warren Lubricant Co., Buffalo, N. Y., was destroyed by fire, May 28. Loss, $140,000, partly covered by insurance.

The Williford Co., Buffalo, N. Y., capitalized at $25,000, has been incorporated by Wm. H. Linford, Wilbraham Knight and others and will establish a factory for the manufacture of perfumes and toilet articles.

The plant of the Shults Bag Rack Co., Gowanda, N. Y., is to be enlarged at once and new machinery installed.

The Elite Furniture Co., Jamestown, N. Y., has had plans prepared and will erect a four-story factory, 100x54 ft., on Allen St.

The Flaxen Fibre Down Co., Lockport, N. Y., has disposed of its plant on the Erie Canal, at the foot of the locks, to Canadian investors, who will at once enlarge the plant and add new equipment.

The Clifford Textile Co., Lockport, N. Y., recently incorporated, with capital stock of $40,000, is to build a plant for the manufacture of textiles. J., J. E. and J. F. Clifford are the incorporators.

H. A. Dewey, 96 Liberty St., New York, N. Y., manufacturer of paints and varnish stains, will erect a three-story factory, to cost approximately $135,000, at Concord Ave. and One Hundred and Forty-third St. The property measures 50x75 ft.

The United States Rubber Co., 42 Broadway, New York, N. Y., is contemplating the erection of a new tire plant. The estimated cost is between $3,000,000 and $5,000,000.

The building at 200 East One Hundred and Eighth St., New York, occupied by S. Hertzberg, manufacturer of baby carriages, was damaged by fire, May 25. Loss, $1000.

The American Cyanide Co., Niagara Falls, N. Y., will erect four buildings.

The General Electric Co., Schenectady, N. Y., will build a five-story laboratory building to cost about $300,000. It will also build a two-story addition to its porcelain factory at a cost of $26,000. One story and basement will be added to building No. 7, and one story to building No. 12.

The Gerry Veneer & Lumber Mill Co., Sinclairville, N. Y., will enlarge its plant.

The E. J. Knapp Candle Co., of Syracuse, N. Y., is about to build an addition to its factory, on Free St.

The contract for the construction of a four-story addition, 60x60 ft., to the mill of the Aetna Wright Health Underwear Co., Troy, N. Y., has been awarded. The estimated cost is $25,000.

Fire at Keasbey, N. J., partly destroyed the Didier-March Brick Works, May 25. Loss, $1,000,000. The plant will be rebuilt.

The Celluloid Co., Newark, N. J., will expend $40,000 for erecting a two-story brick structure, measuring 60x65 ft. Hughes & Backoff are the architects.

The new refining building at the plant of the Barber Asphalt Paving Co., at Perth Amboy, N. J., was burned, May 25. Loss, $100,000.

The contract for the new factory for Henry Taubel, hosiery manufacturer, Riverside, N. J., has been awarded. The building will be of brick, two stories and basement, 40x100 ft., and will cost without equipment, $40,000. It will have private power plant, special machinery for the manufacture of stockings, etc. W. E. S. Dyer, Land Title Building, Philadelphia, Penn., is the architect and engineer.

The factory of the Trenton Overall Mfg. Co., 531 North Clinton Ave., Trenton, N. J., was damaged by fire, May 22. Loss, $500.

Robert A. Reichard, West Lawrence St., Allentown, Penn., is about to start building an addition, 137x50 ft., to his hide, tallow and fertilizer plant. He will install the most improved machinery for the manufacture of poultry food.

The Greensburg Glass Co., Greensburg, Penn., will erect a two-story factory building, 110x100 ft.

The four-story factory of the Lebanon Steam Laundry Co., at Lebanon, Penn., was destroyed by fire, entailing a loss of $40,000, on May 24.

The boiler house of the Reed Quarries, North Catasauqua, Penn., was destroyed by fire, May 25. Loss, $1000.

The building at 406 Cherry St., Philadelphia, Penn., occupied by Basche & Co., woodworkers, was damaged by fire, May 22. Loss, $500.

John & James Dobson, Philadelphia, Penn., will erect a one-story dyehouse, 20x36 ft., to cost $7000.

The Philadelphia Rubber Works, Philadelphia, Penn., will erect a three-story factory, 40x50 ft.

The John Mawson Haircloth Co., East Venango St., Philadelphia, Penn., has completed plans for an addition to be built to its factory. The new building will be of brick, mill construction, three stories and basement, 48x148 ft.

Stuckert & Sloan, Crozer Building, Philadelphia, Penn., have completed plans and will build, at Thirty-seventh and Reed Sts., an addition to the plant of the Philadelphia Rubber Works, Land Title Building. The building will be three stories, of brick and structural steel.

The contract for the addition to the silk dyeing mill to be built at Willand and Jasper Sts. for the Peerless Co., 1845 East Willard St., Philadelphia, Penn., has been awarded. The building will be four stories high, 43x92 ft., and will cost about $25,000. Jacob Naschold, 723 Walnut St., is the architect.

The Philadelphia Warehousing & Cold Storage Co., Delaware Ave. and Noble Sts., Philadelphia, Penn., has completed plans for a new boiler house, to be built at Front and Noble Sts. It will be a brick and structural-steel building, 25x40 ft.

The grain drying factory of J. W. Walters, Thirtieth and Master Sts., Philadelphia, Penn., was damaged by fire, May 25.

The Duff Mfg. Co., manufacturer of hydraulic jacks, Pittsburgh, Penn., is having plans prepared for a new plant, to be erected on Preble Ave. It will cover about 75,000 sq.ft. of floor space. The W. G. Wilkins Co., Westinghouse Building, is the architect.

The Schenley Distillery Co., Schenley, Penn., was damaged by fire on May 24. Loss, approximately $800,000.

The factory of T. J. O'Connor & Son, manufacturers of harness and saddlery, 9 East Pratt St., Baltimore, Md., was damaged by fire, May 28. Loss, $55,000, covered by insurance.

The factory of the R. P. Andrews Paper Co., 629 Louisiana Ave., Washington, D. C., was destroyed by fire, May 24. Loss, $150,000.

SOUTHERN STATES

The Tygarts Lumber Co., Mill Creek, W. Va., will erect a single-band mill to replace one damaged by fire.

W. R. Stroupe, 211 East 4th St., Charlotte, N. C., will erect a four-story brick building, 40x149 ft., to be equipped for the manufacture of carriages.

D. Y. Cooper will erect a factory building sufficient for 10,000 spindles and other necessary equipment, at Henderson, N. C.

The Pee Dee Mfg. Co., Rockingham, N. C., will erect an addition and install 3000 spindles, 136 looms, etc.

H. Mahler's Sons, Raleigh, N. C., will install additional machinery and enlarge storeroom and make improvements to their plant.

The Southport Light & Power Co., Southport, N. C., will erect an electric plant, 35x67 ft.

The Ella Mfg. Co., Shelby, N. C., will erect an additional building and equip it with machinery.

The Wilmington Ice & Storage Co., Wilmington, N. C., recently incorporated, with a capital of $100,000, will construct an ice plant, with a daily capacity of 10 tons.

The Tar River Hosiery Mill, Washington, N. C., was destroyed by fire, May 25. Loss, $20,000, covered by insurance.

The Commissioners of Public Works, Barnwell, S. C., will construct an electric-light plant.

S. F. Brasington, Camden, S. C., will rebuild his shingle mill, recently destroyed by fire.

The Carolina Mills will double the capacity of its plant at Greenville, S. C.

The Ware Shoals Mfg. Co. will erect a three-story addition to its plant at Ware Shoals, S. C.

The Hetrick Hosiery Mills will build a three-story, 26x65-ft. factory, 4-in. ell, at Walhalla, S. C.

E. H. Callaway, owner of the Hardwood Lumber Co., Augusta, Ga., will remodel the plant and manufacture hardwood lumber products.

The factory of the Warren Mfg. Co., manufacturer of suspenders, 58 West Mitchell St., Atlanta, Ga., was damaged by fire, May 26. Loss, $50,000.

The Empire Cotton Oil Co., Atlanta, Ga., will erect mills in the principal cities of the South.

The Berner Ginning Co., Berner, Ga., will erect a gin.

C. R. McRae, Boston, Ga., will build a cotton gin to cost $4000.

The Southern Cotton Oil Co., 25 Broad St., New York, N. Y., will erect a cotton gin at Jackson, Ga.

The city of Jesup, Ga., has voted a bond issue of $35,000 for erecting a light plant.

The Macon Cabinet Works, Macon, Ga., will erect a plant to replace the one recently destroyed by fire. Electrical driven machinery will be installed throughout. Noted May 29.

James Darby, Walhalla, S. C., contemplates erecting a barrel-stave plant at Macon, Ga.

The waste house and press at the Strickland Cotton Mill, Valdosta, Ga., was damaged by fire, May 23. Loss, $1000.

J. G. Granbery, Waycross, Ga., will erect a cabinet factory and will need new machinery.

The Southern Paving & Construction Co. will erect a creosote plant to cost $3000, at Fisherville, Fla.

The Union Cypress Co., Melbourne, Fla., is erecting a mill, 52x150 ft., and will equip it with machinery.

The Wauchula Mfg. Co., Wauchula, Fla., will install an electric plant for the city. The company will also rebuild its crate mill recently damaged by fire.

B. B. Comer, Birmingham, Ala., will erect a cotton mill, costing $500,000.

B. B. Comer, Birmingham, Ala., will erect a cotton mill.

The Home Fertilizer & Cotton Oil Co., Headland, Ala., will erect a cotton gin and fertilizer plant.

The Manchester Sawmill Co., Manchester, Ala., will install machinery in place of that destroyed by fire.

The planing mill at the sawmill of J. E. Felton & Son, Prattville, Ala., was destroyed by fire, May 24.

The Sheffield Button Co. is erecting a factory, at Sheffield, Ala.

The St. Clair Land & Lumber Co., Birmingham, Ala., will erect a sawmill and dry kilns, at Stewart, Ala.

W. A. Kirkpatrick, manager, Sycamore Plantation Co., will install a 7-ft. band mill at Natchez, Miss.

City granted franchise to H. F. Russell and L. A. Lundy for the erection of an electric-light and power plant, at Ocean Springs, Miss.

The Roberts Lumber Co., Allis, La., will erect a sawmill.

The sawmill of the Krause & Managan Lumber Co., at Foley's Spur, near Lake Charles, La., was entirely destroyed by fire, May 22.

The city of Arlington, Tenn., is planning the installation of a water plant to cost $10,000.

The Decherd Mill Co. contemplates the erection of an electric-light plant at Decherd, Tenn.

Hagan & Fletcher will erect a phosphate mill to cost $3500 at Nashville, Tenn.

Kent C. Barber has awarded the contract to erect an ice plant at Bardstown, Ky.

Knight & Bell, Hopkinsville, Ky., will build sawmills at Cadiz, Ky.

J. E. Gowdy, Campbellsville, Ky., will erect a plant to manufacture staves, barrels, etc.

The Wilborn Oil Works, Covington, Ky., has let the contract for a boiler-house addition to its plant.

City granted a franchise to the Moss Milling Co., Greensburg, Ky., to construct an electric-light plant.

The Eberman Water-Works Co. contemplates the erection of an electric-light plant at Morgantown, Ky.

The factory of the Hardy Buggy Co., Paducah, Ky., was damaged by fire, May 24. Loss, $40,000; insurance, $15,000.

MIDDLE WEST

The Miller Rubber Co., Akron, Ohio, will erect a plant for the manufacture of rubber products.

The Consolidated Stone Co., Bedford, Ohio, and Bloomington, Ind., has purchased the mill of the Dugan Stone Co., and will enlarge the plant.

The J. & F. Schroth Packing Co., Cincinnati, Ohio, will install additional power-plant equipment.

The Eagle White Lead Co., Cincinnati, Ohio, is considering the erection of a four-story factory and storehouse, on Hunt St. The estimated cost is $23,000.

The C. A. Kreimer Co., 813 Main St., Cincinnati, Ohio, will erect a plant to manufacture furniture.

The National Tool Co., Cleveland, Ohio, maker of machine tools, will build a new large power house and install power-plant equipment.

Walker & Weeks will receive bids on the three-story brick factory building, to be built for S. Korach, on Superior Ave., in the new textile center, Cleveland, Ohio.

A six-story building, 100x460 ft., will be built by the Kinney & Levan Co., Cleveland, Ohio, manufacturer of crockery. Power plant, heating plant and complete electric-lighting plant will be needed. Walker & Weeks are the engineers.

The city council has prepared resolutions authorizing the Cleveland Electric Ry. Co., Cleveland, Ohio, to spend $139,000 for equipping a new power substation, $27,000 for signaling devices and $97,000 for new motors. J. A. Stanley is the president.

Fire destroyed the plant of the Farr Brick Co., on Reeves Ave., Cleveland, Ohio, at a loss of $35,000.

The W. S. Ferguson Co., Cleveland, Ohio, is preparing plans for a $50,000 power plant to be erected at Port Clinton, for the American Gypsum Co. Bids will be ready by June 10.

The city of Cleveland, Ohio, has advertised for bids for a complete electric generating equipment for the city water-works department. W. J. Springborn will receive bids until June 12, 1912.

The H. L. Brown Fence Co., Cincinnati, Ohio, will erect an addition to its plant in Oakley, Ohio.

The Cement Products Machinery Co., Columbus, Ohio, has been incorporated for $50,000 by W. F. Felton and Wm. H. Sharp to equip a factory to make machinery to manufacture cement-making machinery.

The Riley Shoe Co., Columbus, Ohio, contemplates the erection of an addition to its plant on South Fourth St.

The plant of the Columbus Bank Note Co., Columbus, Ohio, was damaged by fire, May 25. Loss, about $20,000, covered by insurance.

Bids will be received until June 26, by the Ohio Board of Administration, at Columbus, Ohio, for furnishing and installing motor-generator sets for the State Institution for Feeble Minded.

The Coshocton Glove Co., Coshocton, Ohio, which has opened a branch factory at 197-199 East Gay St., Columbus, will build a factory in Columbus, at a cost of about $40,000.

Butter machinery and power-plant equipment will be purchased by the Ottawa Creamery Mfg. Co., at Curtice, Ohio. G. K. Southard is the manager.

The North Electric Co., Galion, Ohio, will erect a two-story factory. G. C. Steele is the secretary.

The M. Werk Soap Co., Cincinnati, Ohio, will erect new factory buildings at St. Bernard, Ohio.

Wood-working machinery will be purchased by the Robinson Cabinet Mfg. Co., Toledo, Ohio.

The Dolphin Hose Co., Toledo, Ohio, is erecting an addition to its present plant.

The Toledo Sugar Co., Toledo, Ohio, has awarded a contract for a large beet sugar plant addition at Rossford.

The Eavey Packing Co., Xenia, Ohio, will erect a new three-story packing plant, 60x144 ft.

Ground has been broken for the Bosse Furniture Factory dry kiln on the West Side, Evansville, Ind. The contract was awarded to John Koch.

The Summit Canning Factory has located at Fort Wayne, Ind., and is making arrangements to erect a large plant.

The Ball Bros.' Glass Co., Muncie, Ind., will erect a three-story factory building to cost $20,000.

The Hoosier Mfg. Co., Indianapolis, Ind., will erect a three-story factory building, 90x400 ft., at Newcastle, Ind., to manufacture kitchen cabinets.

The Big Rapids Furniture Co., Big Rapids, Mich., has awarded the contract for a new two-story and basement furniture plant, 43x120 ft. J. P. Marting is the architect. Cost, $30,000.

The Harding Lumber Co., Detroit, Mich., was damaged by fire at a loss of $10,000. It will be rebuilt.

Walker Bros., 29 Farmer St., Detroit, Mich., will erect a one-story bakery, 79x83 ft.

The Goldstein Sausage Works, at 259 Winder St., Detroit, Mich., was damaged by fire. Loss, $5000.

The Detroit City Gas Co., Detroit, Mich., is erecting a $6800 addition at Station B.

The contract for the construction of a two-story dry-cleaning plant, 64x112, for Otte Bros., 424 South Division St., Grand Rapids, Mich., has been awarded. The estimated cost is $22,000.

Charles Brown, Midland, Mich., will erect a fireproof sawmill.

Goodwillie Bros. are having plans prepared for additional buildings for its box factory at Manistique, Mich.

The Michigan Paper Co., Plainwell, Mich., is having plans prepared for a three-story paper mill, 66x66 ft. The estimated cost is $70,000. D. J. Albertson, 305 East Main St., Kalamazoo, is the architect.

F. B. Kluck, Chicago, Ill., has commenced a five-story brick factory, 160x80 ft., at 2608-18 Harvard St., to be used as a drug factory. New machinery will be needed, including engines and boilers.

The William Wrigley, Jr., Co., Chicago, Ill., has purchased a site at Thirty-fifth St. and Ashland Ave., and will erect a six-story fireproof factory, to make gum.

The plant of the Hepps Co., Chicago, Ill., manufacturers of roofing paper, was damaged by fire, May 24. Loss, $8000.

The C. P. Kimball Carriage Co., Chicago, Ill., is building a new three-story factory, 400x160 ft., of reinforced concrete, at Thirty-ninth St. and Michigan Ave. It will have an entire new power plant, including engine and boilers.

The factory of the Chicago Dryer Co., manufacturer of clothes dryers, Chicago, Ill., was damaged by fire, May 24. Loss, $39,000.

The boiler room of the Parker-Washington Co., Lessing and Dix Sts., Chicago, Ill., was damaged by fire, May 22. Loss, $5000.

The broom and leather factories at Bridewell Prison, Chicago, Ill., were destroyed by fire, May 23. Loss, $50,000. The stock was owned by the Chicago Leather Mercantile Co. and the Chicago Broom Co.

The United Drug Co., Chicago, Ill., will erect a new four-story factory, 100x125 ft., to cost $85,000.

The Kohler Dye & Specialty Co., Chicago, Ill., will erect a $100,000 addition to its plant.

The American Hide & Leather Co., 301 West Lake St., Chicago, Ill., will erect a five-story and basement building.

The Kimball Dietreich Hardware Co., Elgin, Ill., will erect a two-story factory, 35x100 ft., to cost $6000.

The Granby Mining & Smelting Co., 165 Broadway, New York, N. Y., has awarded the contract for the construction of its plant, at East St. Louis, Ill. The estimated cost is $100,000. The buildings include a pottery house, power plant, stock house, two carpenters' buildings and a machinery building.

The Rath Packing Co., Waterloo, Ill., will erect a two-story addition, 64x100 ft., to cost $20,000.

The paper mill of the Centralia Paper & Pulp Co., Grand Rapids, Wis., was destroyed by fire, May 22. Loss, $100,000.

A reinforced-concrete building, for offices and light manufacturing, is to be erected by William Stewart, on Kinnickinnic Ave., between Stewart and Becher Sts., to cost $50,000, at Milwaukee, Wis.

The Kellar & Martner sawmill and box factory was burned at Prairie-du-Chien, Wis.

The Forsyth Leather Co., Wauwatosa, Wis., is contemplating the erection of two concrete additions to its factory. One will be one-story, 45x300 ft. Charles S. Forsyth is president.

WEST OF THE MISSISSIPPI

A. W. Johnson, Allison, Iowa, is interested in a new creamery which is being constructed there.

The Booth Fisheries Co. has had plans prepared for the construction of a nine-story cold-storage plant, at Fifth St. and Third Ave., Minneapolis, Minn. The estimated cost is $300,000. Charles W. Turner, 207 North Fifth St., St. Paul, Minn., is manager.

The alfalfa mill of W. B. Martin, Dodge City, Kan., was burned, May 21. Loss, $10,000, with no insurance.

Robert Billard, Topeka, Kan., is having plans prepared for the construction of a large cold-storage plant, at Topeka. It will be a five- or six-story structure.

The plants of the Graham Paper Co. and the Niehaus Refrigerator Co., 12th and Poplar Sts., St. Louis, Mo., were destroyed by fire, May 25. Loss, $30,000.

Frederick Moser, Milwaukee, Wis., is contemplating the establishment of a woodworking plant, at St. Louis, Mo.

T. J. Hannan, St. Louis, Mo., and associates, are planning to install a large hydro-electric plant on the Ouichita River. They will construct power-transmission lines to Little Rock, Hot Springs, Pine Bluff, Argenta, Ark., and other industrial centers. The proposed plant and power system will cost about $2,000,000.

The plant of the Eldorado Light & Water Co., Eldorado, Ark., was destroyed by fire, May 15. Loss, $25,000, partly covered by insurance.

The city of Cooper, Tex., is planning to install a water-works plant and a distributing system.

The Denton Pressed Brick Co., Denton, Tex., is planning to double the capacity of its brick factory. Eight new kilns will be constructed.

Nolen's Gin, Granger, Tex., was destroyed by fire, May 20. Loss, $8000, partly covered by insurance.

C. W. Post, Battle Creek, Mich., is promoting the establishment of a large cement factory at Justiceburg, Tex.

The Kingsville Cotton Oil Co., Kingsville, Tex., has had plans prepared for the addition of a refining plant to its cotton-oil mill and gin. The estimated cost is $50,000.

The factory of the Cummer Crate Co., at Paris, Tex., was destroyed by fire, May 22. Loss, $40,000.

Z. T. and J. T. Northcutt, Plainview, Tex., owners of the South Plains Tile Co., will establish a large plant at Plainview, for the manufacture of drainage and irrigation tile.

The Postex Cotton Mills, Post, Tex., has been incorporated with a capital of $550,000. The incorporators are: C. W. Post, Arthur B. Williams and Henry C. Hawk, Battle Creek, Mich. The company will erect a plant for the manufacture of cotton fabrics.

The Post Power Co., Post, Tex., is planning to install an electric-light and power plant at Post. C. W. Post, Battle Creek, Mich., is interested.

The Rule Cotton Oil Co., Rule, Tex., has increased its capital from $50,000 to $80,000, and will enlarge and improve its plant.

The Secumseh Oil & Cotton Co., Sherman, Tex., has increased its capital from $75,000 to $100,000, and will make improvements to its plant.

The Shiner Oil Mill & Mfg. Co., Shiner, Tex., has increased its capital to $50,000, from $30,000, and will make improvements to its plant.

Colley & Billingsley, Stockdale, Tex., who are building an ice factory at Stockdale, contemplate the installation of an electric-light and power plant.

The Texas City Co., Texas City, Tex., has awarded the contract for the construction of its new cotton compress.

The Alfalfa Meal Millers Co., San Francisco, Calif., is planning to install an alfalfa plant at Carlsbad, N. M. The estimated cost is $15,000.

WESTERN STATES

The city of Burley, Idaho, will soon hold a special election to vote bonds for the installation of a new water-works system.

H. H. Heath, McNeal, Ariz., is planning to erect a broom factory, at McNeal.

The plant of the Williams Electric Light & Power Co., Williams, Ariz., was damaged by fire, May 8. Loss, $30,000. J. C. Phelan, Fresno, Calif., is one of the principal stockholders.

The city of Central'a, Wash., has voted bonds for $250,000 for the installation of a water system.

The city of Chehalis, Wash., has voted bonds for $185,000 for the installation of a gravity water system.

The lumbering plant and other buildings of the United States Lumber Co., Darrington, near Everett, Wash., were destroyed by fire, with a loss of $30,000.

The mill of the Baring Shingle Mill Co., Index, Wash., which was recently destroyed by fire, will be reconstructed at once. Noted May 30.

The Zimmermann-Degan Shoe Co., Seattle, Wash., recently incorporated, has secured a site, 228x120 ft., at Ewing St. and Wallingford Ave., and will erect a factory. It will be of concrete, glass and steel, and will cost about $30,000. Saunders & Lawton are the architects.

The factory of the Crest Chemical Co., Bell St. and Western Ave., Seattle, Wash., was damaged by fire, May 15. Loss, $2500.

The factory of the William H. McMonies Co., manufacturer of harness, Union Ave. and East Ash St., Portland, Ore., was destroyed by fire, May 23. Loss, $75,000; insurance, $35,000.

The Union Ave. Planing Mill, 1338 Union Ave., Portland, Ore., was damaged by fire, May 14. Loss, $5000.

P. W. Geiser, Silverton, Ore., is planning to erect a flour mill, at Salem, Ore. The estimated cost is $20,000. It will be known as the Cherry City Milling Co., and will have a daily capacity of about 100 bbl.

The Arden Plaster Mills, at Arden, Calif., were destroyed by fire, May 10.

The city of Fullerton, Calif., is considering the installation of a municipal water system. The estimated cost is $65,000.

The Holton Power Co., Imperial, Calif., will erect a transformer house and cold-storage plant, at Heber, Calif.

The Los Angeles Gas & Electric Co., Los Angeles, Calif., is planning to erect an addition to its building for compressors and boilers at the Ducommun St., Los Angeles, gas works.

The Salyer Piano Co., Los Angeles, Calif., has started the erection of its piano factory, at Glendale, Calif. It will include a sounding-board room, construction room, cabinet and veneer-working rooms. A second structure will be erected for the manufacture of cases, backs and pin blocks, with room for machinery and engines. The factory will have a capacity of 60 pianos a month. A. M. Salyer is president.

Plans have been completed for a plant for the Pacific Sewer Pipe Co., Los Angeles, Calif., to be erected at Los Nietos, Calif. It will include a main building, 200x660 ft., a power house, 40x110 ft., and two press rooms, each 45x70 ft. A compressor plant and an electric plant will be installed. Noted May 30.

W. H. Garvin, Los Angeles, Calif., is planning the erection of an apple-packing plant, at Delta, Colo. A. L. Acker, Story Building, Los Angeles, is the architect.

Thompson Swayne, Oakland, Calif., has acquired a site, near Porterville, Calif., and will install a pumping plant.

The seed mill of the Oakland Mercantile & Warehouse Co., at 1568 Fifth St., Oakland, Calif., was destroyed by fire, May 20. Loss, $40,000, partly covered by insurance.

The International Seaweed Products Co., San Diego, Calif., is planning to erect a plant in San Diego for extracting potash from seaweed. Ellis O. C. Smith and Fred R. Paulson are interested.

The Standard Biscuit Co., San Francisco, Calif., is planning to erect a large addition to its factory.

The San Joaquin Light & Power Co., San Francisco, Calif., will sink a well, and install a large pumping plant, at Selma, Calif., to increase the water pressure.

The Pacific Porcelain Works, San Francisco, Calif., will erect a large factory, at Richmond, Calif., for the manufacture of porcelain ware.

The California Grain Distilling Co., San Francisco, Calif., recently incorporated, with a capital of $500,000, is contemplating the erection of a plant with a daily capacity of about 200 bbl.

The plant of the Cline Lumber Co., Sumas, Calif., was destroyed by fire, May 18. Loss, $10,000.

R. H. Beaver, Tulare, Calif., will install an electric pumping plant on his ranch, near Tulare.

The city of Turlock, Calif., is planning to make extensions to its water-works system. An auxiliary pumping station will be erected. A pump with a capacity of 2200 gal. a minute will be installed in the present plant.

The Los Angeles Ice & Cold Storage Co., Los Angeles, Calif., will erect an ice and cold-storage plant, at Van Nuys, near Los Angeles.

The Breennan Tannery & Shoe Mfg. Co., Upland, Calif., has been incorporated with a capital stock of $100,000. The incorporators are J. J. Atwood, Charles Ruedy and E. M. Dillman. The company will erect a plant at Upland.

The Alaska Fish Products Co., Seward, Alaska, recently incorporated, will erect a plant at Seward for the manufacture of fish oils, soap stock, glue stock and fertilizer. Dr. H. E. Elliott is interested.

CANADA

The Westgates Saw Mill at Cookshire, Que., was damaged by fire, May 25. Loss, $7000, partly covered by insurance.

The buildings of the City Ice Co., Hudson, Que., were destroyed by fire, May 24. Loss, $80,000; insurance, $24,000.

The Fort William Coal Dock Co., Fort William, Ont., will equip a new electrical-power house, at Fort William. The estimated cost is $25,000.

The two sawmills of Graves, Bigwood & Co., at Byng Inlet, Ont., were burned, May 20. Loss, $200,000, covered by insurance.

The Globe Furniture Mfg. Co., New Hamburg, Ont., is planning to enlarge and improve its plant.

The Valentine & Martin Shoe Co., New Hamburg, Ont., is planning to double the capacity of its factory.

The flour mills known as Brown's Mills and owned by Robert Cooper, Welland, Ont., were destroyed by fire, May 24. Loss, $20,000.

The plant of the Great West Coal Co., Clover Bay, near Edmonton, Alta., was destroyed by fire, May 25. Loss, $75,000, covered by insurance.

The Manitoba Cold Storage Co., Winnipeg, Man., is having plans prepared for a four-story cold-storage plant, 100x150 ft. The estimated cost is $75,000. H. P. Henschein, 431 Dearborn St., Chicago, Ill., is the architect.

The New Model Laundry Co., Victoria, B. C., recently incorporated, will erect a plant, at Victoria. The estimated cost is $10,000.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture.

The Ideal Coated Paper Co., Brookfield, Mass.; papers. Capital, $150,000. Incorporators, George Goodsie, Jr., 632 East Twenty-sixth St., New York, N. Y.; John McLaurin and William M. McLaurin, Brookfield, Mass.

The Cote Piano Mfg. Co., Fall River, Mass.; pianos. Capital, $750,000. Incorporators: Edmund Cote, Fall River, Mass., and Donald M. Hill, 35 Congress St., Boston, Mass.

The Wakefield Slipper Co., Lynn, Mass.; shoes. Capital, $25,000. Incorporators, W. A. Cook and A. Lord, Lynn.

The F. B. Tilton Co., Natick, Mass.; paper boxes. Capital, $2000. Incorporators: Frank B. Tilton, Natick, Mass.; A. Mehlinger and E. Mehlinger, Boston, Mass.

BUSINESS ITEM

Plans have been made by Charles H. Besly & Co., Chicago, to double the size of its plant at Beloit, in order to take care of its rapidly increasing business.

FORTHCOMING MEETINGS

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 12-14. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, secretary, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

MEN WANTED

Connecticut

ENGINEER-SALESMEN—Manufacturer of well known high-grade automobile, about to place motor trucks on market, has opening for several engineer-salesmen competent to take charge of truck departments at its branches as business develops; experience in motor trucks not required, but selling ability and mechanical knowledge essential; exceptional opportunity for men of proper caliber; state experience, references, salary desired, age, married or single. Address "R. S.," Am. Machinist.

Illinois

DRAFTSMAN—High grade detailer with experience on automatic machinery; permanent position with prospect of advancement to the right man; state experience and wages expected; also give references. Box 397, Am. Machinist.

DRAFTSMEN AND TRACERS—We are constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

SUPERINTENDENT, a high grade, or foreman for tool room in modern factory; must be competent teacher of men and thoroughly conversant with improved shop methods; give experience and references. Box 337, Am. Machinist.

SUPERINTENDENT for a department of our works devoted to the manufacture of very accurate small cast iron and steel gears; must be a high grade, high minded mechanic who is naturally qualified to train and hold his workmen and who is well informed on modern tools and shop practices; information as to experience, references and qualifications for such position will be treated confidentially; a good opportunity for the right man. Box 336, Am. Machinist.

Kentucky

BENCH HANDS, milling machine, and assemblers accustomed to typewriter work; state experience and compensation expected; steady work. Address Universal Stenotype Co., Owensboro, Ky.

Massachusetts

DIE SINKER, first-class, experienced on small follow-up dies; 40c. to 50c. per hour, according to ability; steady work; Boston. Box 355, Am. Machinist.

DESIGNER, competent, with experience and originality on automatic machinery; position permanent for accurate steady man; state age, references and salary. Box 405, Am. Machinist.

Michigan

OPERATORS—We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

HARDENER with experience in modern methods of case hardening; must also be able to harden high speed steel, cutters, taps, dies and reamers; furnish references; state salary; good opportunity for advancement. Box 412, Am. Ma.

ASSISTANT PURCHASING AGENT; must have good experience, good address, be a close buyer and competent to handle good big proposition; prefer a young man who is looking for advancement as result of conscientious work. Box 371, Am. Machinist.

New Jersey

MACHINISTS AND TOOL MAKERS—A number of very high-grade, on first-class work; must be well recommended. Box 396, Am. Machinist.

New York

OPERATOR—An experienced B. & S. automatic screw-machine operator, preferably also familiar with the Hartford automatics. Box 366, Am. Machinist.

FOREMAN, young or middle aged, for small jobbing and repair shop working about 20 men; a live wire with some idea of shop management who can get along with men; state experience; good future. Box 363, Am. Machinist.

OPERATORS—Automatic screw machine operators on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co., Rochester, N. Y.

MECHANICAL DRAFTSMAN, experienced in the design of tools for sheet-metal drawing, cutting and forming; must be good practical man; state experience, salary expected and when available. Box 392, Am. Machinist.

DESIGNER, experienced on woodworking machinery for a large shop in New York state; must be familiar with shop practice and operation of machines; give references and salary expected. Box 331, Am. Machinist.

MECHANICAL DRAFTSMAN, first class, on special and automatic machinery; permanent position and good opportunity for advancement for the right man; state experience, age and salary expected; application considered confidential. Box 413, Am. Machinist.

MECHANIC, competent to take charge of new shop; must be thoroughly experienced in quantity production in sheet metal, including press work, drawing and spinning; must have actual experience in handling men and should live near New York; state age, refer-

ences and salary expected. Box 395, Am. Machinist.

Salesman calling on machine shops and factories to sell and handle as a side line high-speed steel, drills, milling cutters, hack saws, etc. Box 391, Am. Mach.

Ohio

PATTERN MAKER wanted. Box 390, Am. Machinist.

SALESMAN, first class, to sell automatic screw machines; good job for the right man. Box 409, Am. Machinist.

MACHINE TOOL SALESMAN, first class, wanted for New England territory; permanent position for the right man; none but experienced salesman considered. Box 408, Am. Machinist.

TOOL HARDENER required to harden all kinds of milling cutters and other small tools made from high speed and carbon steels; good position and first class factory; correspondence confidential. Box 411, Am. Machinist.

BY A LARGE CONCERN in Ohio, a capable man to take charge of tool making and designing; experienced on cutting tools for monitors and screw machines; give age, experience, references and salary expected. Box 362, Am. Mach.

A MAN of good mechanical ability and initiative to locate and remedy troubles, follow new work and perfect process in several departments dealing with power presses, furnace ovens, and general machine tools; give age, experience, references and salary expected. Box 361, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

CHIEF DRAFTSMAN — Desire man with experience in machine-shop practice and familiar with gas-engine design. Box 386, Am. Machinist.

OPERATORS, first-class, on Gisholt turret lathes and Gridley automatics; in writing state age, experience and pay desired. Box 365, Am. Machinist.

TOOL DESIGNERS, first-class, on jigs and fixtures; only men capable of designing and making the drawings need apply. Address "Employment Department," P. O. Box 911, Pittsburgh, Penn.

DRAFTSMEN, several; applications solicited from men with either ordnance, mechanical-electrical, or mechanical-structural experience; state fully age, experience, education and salary expected. Box 319, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Rhode Island

FOUNDRY FOREMAN, an experienced man as assistant to superintendent in a large foundry; state age, experience and wages required. Box 398, Am. Machinist.

Wisconsin

MANUFACTURING concern desires a man with some experience to take charge of chemical and physical laboratory, steel work chiefly, including analysis and heat treatments. Address, stating experience and salary, Box M. L., Am. Mach.

Positions Wanted

Connecticut

FOREMAN, first-class tool and die maker, 32, sixteen years' experience on sheet metal tools, model and experimental work, desires responsible position. Box 401, Am. Machinist.

FOREMAN pattern maker wishes to make change; man of exceptional ability familiar with wood, metal and molding machine; good organizer and productive agent. Box 372, Am. Machinist.

Illinois

DESIGNING DRAFTSMAN, young man of exceptional ability on small automatic machines, labor saving tools and interchangeable manufacture, desires responsible position. Box 406, Am. Machinist.

SUPERINTENDENT—Mechanical engineer, familiar with manufacturing methods and factory design, and experienced in materials, labor, processes, costs and economical operating of power plants and factories wants position as superintendent or manufacturing engineer. Address Box 403, Am. Machinist.

Massachusetts

TECHNICAL GRADUATE desires change; has had five years' experience in manufacturing specialties and small tools, with cost and office experience. Box 389, Am. Machinist.

GENERAL FOREMAN — Thoroughly familiar with accurate interchangeable machine parts; expert mechanic; 10 years in charge of men; permanent position; references. Box 399, Am. Machinist.

CHIEF DRAFTSMAN and mechanical engineer desires change in position; university education; mechanical and electrical experience in all branches of design, shop production and cost; good organizer and systematizer; high-speed design a specialty. Box 402, Am. Mach.

New York

MECHANICAL DRAFTSMAN wishes position. Box 388, Am. Machinist.

SUPERINTENDENT of machine shop, foreman of tool room or general foreman. Box 414, Am. Machinist.

YOUNG MAN with practical experience on accurate work in the tool room and on the milling machine and considerable technical education, desires a position in charge of milling machine department in manufacturing plant or tool room; can and will produce results. Box 404, Am. Machinist.

TOOL-DIE MAKER, 33 years old, technical education, 17 years' experience, wishes to elevate his position; experienced on die sinking, cutting, drawing, dies, and expert on die castings; also draftsman and experimental work; able to take charge; A-1 references. Box 376, Am. Machinist.

EXPORT MANAGER, energetic, 30, years old, with selling ability, wants position as export manager or salesman in foreign countries; has thorough commercial and technical training, including machine-shop practice; can show splendid record and speaks English, French and German; can furnish high-class references. Address "Success," Box 410, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

SUPERINTENDENT, 34; expert in manufacturing at low cost; extensive experience in equipping machine tools for making large variety of parts; successful in introducing simple and practical factory system with large concerns of highest reputation; can lay out plant with idea of taking care of continuous extensions; engaged but desires change, preferably with growing concern manufacturing specialties. Box 407, Am. Mach.

AN EXECUTIVE position with some progressive concern in northern or central Ohio by an A1 mechanic and executive; good organizer and systematizer; thoroughly familiar with the latest and best method of producing interchangeable parts accurately and economically; have had extensive experience as master mechanic and supervisor of some of the best factories in the country manufacturing the most delicate and accurate machines; at present superintendent of a large machine tool company in a western city; excellent reason for desiring to locate in Ohio; A1 reference. Address "Executive," Am. Machinist.

Pennsylvania

SUPERINTENDENT, now holding this position in a large plant, high-grade work, wants a change; thorough mechanic; good executive ability. Box 346, Am. Machinist.

SUPERINTENDENT or foreman, by experienced man of 35; at present in charge of a large concern manufacturing brass goods; can produce results. Address Box 394, Am. Machinist.

Vermont

DESIGNER, technical education; four years' practical shop and six years' designing experience on jigs, fixtures and special machinery, wants position. Box 393, Am. Machinist.

Wisconsin

SALES ENGINEER with wide experience on high-grade automatic machinery desires position where combined experience as machinist, designer, superintendent and successful salesman would count; would make investment with right concern. Box 367, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

For Sale—Complete and only machine shop in best and fastest growing city in southeast Missouri. Box 338, Am. Mach.

For Sale—Newman watchman's clock or time detector fitted complete for nine stations; just as good as new. The Gier & Dail Mfg. Co., Lansing, Mich.

Machine to twist 1" to 2"x$\frac{1}{8}$"x6 ft. steel wanted; every twist must be same distance apart. Send catalog and prices to the Leetonia Tool Co., Leetonia, Ohio.

For Sale — Machinists, tool makers, draftsmen: We have a few tool cases to sell at a sacrifice; write us at once. The Ohio-National Mfg. Co., Chillicothe, Ohio.

Four No. 1 Acme automatic screw machines, $\frac{7}{16}$-in. capacity; now running in our shops. Kellogg Switchboard & Supply Co., Congress & Green Sts., Chicago, Ill.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

Experimental apparatus or anything needing extra good machine shop work and oversight can be economically built at my new laboratory and shop. A. H. Emery, Stamford, Conn. Works at Glenbrook, Conn.

Manufacturers of high-grade, high-speed marine gasoline motors, going out of business, will sell cheap for cash, drawings, patterns and fixtures for six different sizes of motors, from one to four cylinders and from 6 hp. to 50 hp.; write for detailed information. Box 387, Am. Machinist.

Machine shop wanted in the vicinity of New York City, with equipment adapted for the manufacture of small and medium size electric machines and devices; in replying, give full particulars, location, rent, price, etc. Address Box 3-E, care Doremus & Co., 44 Broad St., New York.

Machine tools and small tools—Alfred Herbert, Ltd., Coventry, having an extensive organization and a large staff of salesmen especially engaged on machine tools and small tools in Great Britain, France, Germany, Italy, Switzerland, Belgium, India and Japan, are open to handle good agencies of all kinds and invite correspondence with manufacturers.

Good opening for a young man with a few thousand dollars to take one-half my stock in a Massachusetts corporation, building a full line of special machine tools; uptodate plant, fully equipped with modern tools; remodeled in 1905; capacity, 60 men; in a good financial condition; thorough investigation given; reason for selling, poor health. H. A. Barnes, 326 A St., Boston, Mass.

For Sale—Two 10x17x12" tandem compound center-crank Ames engines, now running on 125 lb. steam pressure, 270 r.p.m., direct-connected to 75-kw., compound-wound, 500-volt, direct-current General Electric generators; one 12"x12" plain center-crank Ames engine, now running on 125 lb. steam pressure, 300 r.p.m.; all in good running order and being sold to make room for larger installation. May be seen at power plant of Farrel Foundry & Machine Co., Ansonia, Conn.

Talks With Our Readers

By The Sales Manager

"Here," said my friend the Purchasing Agent, as we passed through his office, "is the card index of advertisements that I mentioned the other day. You will notice that there is a division card, every little way, with the name of the subject, like 'Abrasives,' 'Boring Mills' and so on. Each card relates to a separate article in our purchase list and contains only the most pertinent information concerning it. When the article is out of date or has been entirely supplanted, so far as we are concerned, by something very much better, its card is still kept for possible future reference but goes into retirement in one of the bottom drawers of the cabinet."

"How long have you been keeping this index?" I asked.

"About 8 years," he stated.

"My object originally was rather different from what it developed into. As you know, this department is necessarily a large one, having also charge of the stores and tool rooms, and there is a great deal of detail to handle for works of the size of ours. I use young men entirely for clerks and stenographers, with the object of promoting them to positions of responsibility as they develop the necessary capacity.

"Well, one year two of my best assistants had been taken by neighboring concerns at higher salaries than I was authorized to pay, and three or four others were wanted by other departments of our company; so I felt it would be a good thing to see what could be done about shoving up some of the boys from the bottom positions. After thinking the matter over, I called the bunch into my office.

" 'Boys,' said I, 'there are going to be some good positions open in this department within the next year or two, and the best men will get the promotion when it comes. Now, one of the things required is a knowledge of the machinery and supplies that we are buying right along. Some of this you absorb in the course of your daily work, but the kind which will make you valuable assistants to Mr. James here and myself goes a great deal farther than that.

" 'Now,' said I, 'here are some of the papers we consult most frequently. I want each one of you to take a paper home with him and study the advertisements. Pick out those that seem to you to tell something worth while; talk about them with some of the shop foremen, if you like, and then let me know what you have found.' "

"Did they bring in much?" I inquired.

"A most amazing lot," he answered. "Some of the boys found more than I would have seen for myself in ordinarily looking through the papers, and I had my attention called to quite a number of new features in tools then being brought out which had entirely escaped my attention.

"After talking with the boys about the advertisements that appealed to them and pointing out some of the things they had, themselves, missed, I had them write a few lines on each of the articles selected, giving the salient points in its favor. This was at the suggestion of one of the boys. He also proposed that we put the summaries on cards and add to them as we could, saying that he would be glad to go through at least one of the papers every week.

"Since then it has developed so far that anything new appearing in the AMERICAN MACHINIST, whether a complete tool, an improved feature of standard design or a new claim made for lubricants, is at once spotted and put in the index. If we need a radial drill, for example, we can refer to the cards back of the heading 'Drills, Radial' and find a complete record not only of everyone advertising them but also of the special advantages claimed for each, with a notation such as 'A. M. 4/12/12' referring to the file of papers kept intact in our library. All short printed descriptions of new tools appearing in the reading columns of the journals are also indexed on the same cards; and whenever we have occasion to look up details in catalogs, a slip bearing the initials of the index clerk is left to mark the place; so that a reference to such details can also be made on the cards. The system has, in fact, simply proved invaluable."

"Did the boys follow your suggestion of consulting with the shop foremen before bringing their discoveries to you?" I queried.

"Yes, they did, and I'm glad you asked that question," replied the Purchasing Agent; "for it illustrates some of the benefits the system has brought to us in addition to those of its main purpose. Not only did the boys talk with the shop people in the beginning; but they kept it up, and this habit—for it is now a habit—has put us more closely in touch with the ideas and needs of the production departments than anything else could possibly have done. The friction over purchases which we used to experience occasionally, and the feeling that we were buying merely on a dollars and cents basis, without giving sufficient attention to the judgment of the men who were really to use the tools or material, have entirely disappeared. And that means a good deal, for when we had any such feeling to contend with, formerly, it was apt to cause considerable trouble, with consequent injury to the net efficiency of the establishment.

"Besides, we really are doing much better with our purchases as a result of the closer relations with the works, and each of my assistants has developed into an expert in his particular line.

"The boys of 8 years ago are now, of course, occupying the best positions in the department or else have moved up into other places with the company where the opportunities are good. In fact, we have come to be so much of a training school for the entire organization that I am put to it all the time to keep enough men for my own requirements, but an equally alert lot is always crowding the older boys right along, and I feel that keeping up the index record is what gives them their best experience. Incidentally, also, it has led nearly all of them to read the entire contents of the papers carefully, and in this way we are constantly getting suggestions from descriptions of other plants. Why, only the other day, we cut the cost of one grinding operation nearly in half through learning of the way they were doing it over at Detroit. The boys all look on the system now as a sort of a game, and very little gets by them."

* * *

Only reliable products can be continuously advertised.

Special Cotton-Gin Machinery

By Ethan Viall

An automatic drilling machine with an interesting table feed and a brush-tufting machine.

Method of building up, truing and balancing cylindrical brushes.

A 20-spindle drilling machine.

Perforating apron belts and making distributor belts.

In a previous article we described the method of making and using gin saws, as done in the Avondale and Birmingham plants of the Continental Gin Co., Birmingham, Ala., mentioning the fact that the cotton lint was removed from the saw teeth by means of a revolving cylindrical brush. In this article we will describe the making of these brushes in detail.

The complete brush is made up of a number of long, narrow strips of wood, holding a single row of bristles, which are fastened to wooden disks so as to form a cylindrical brush which is carried on a steel shaft. Beginning with the drilling of these narrow strips, we will take up each detail in order.

Drilling Brush Backs

The long wood strips used for brush backs are placed in an automatic drilling machine, as shown at *A*, Fig. 1. The drilling head of this machine remains stationary and the work is fed to the rapidly revolving drill. The carriage *B* runs on the guide rods *C* and is given a reciprocating motion by means of the crank and connecting rod *D*, run by the belt and pulley *E*. The strip to be drilled is clamped into a carrier *F*, which runs on ways crosswise of the carriage. Bolted to this carrier is a ratchet-toothed rack *G* with accurately spaced teeth.

A sliding block *H* has a pawl *I* fastened to it by the bracket *J*. As the carriage moves forward a block *H* is forced over toward the beveled block *K* by the flat spring *L*, and the pawl is moved back along the rack the space of one tooth. The block *K* is bolted to the bed of the machine so that as the carriage returns the end of the block *H*, sliding on the angled end of the stationary block *K*, forces the carrier forward the space of one ratchet tooth.

The device is, of course, set so that the feeding of the carrier does not start

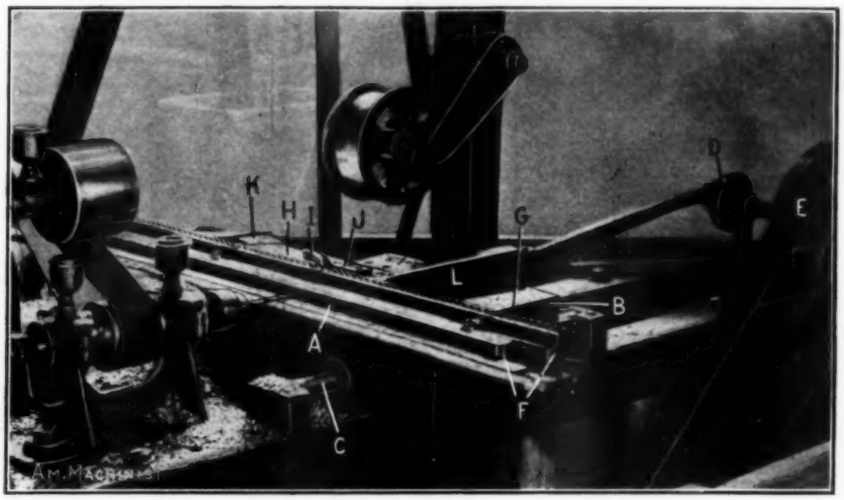


Fig. 1. Automatic Brush-back Drilling Machine

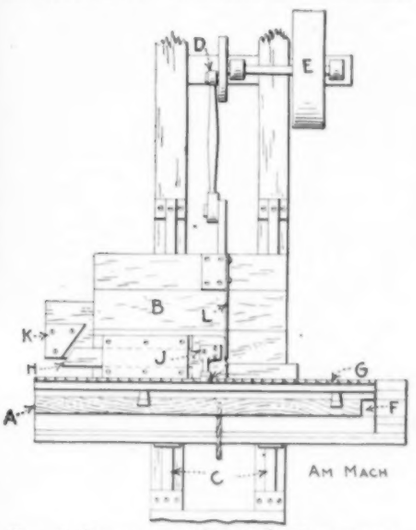


Fig. 2. Details of Feeding Movement

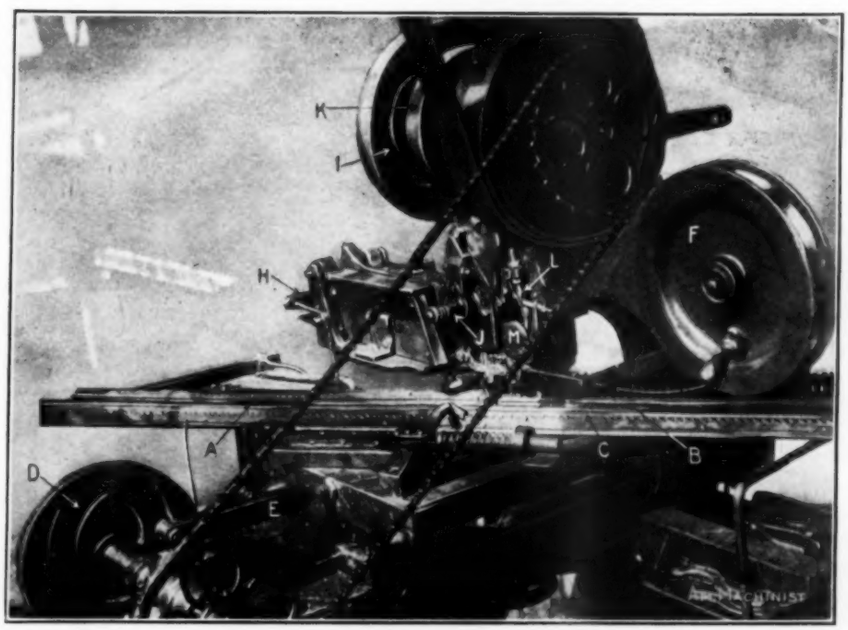


Fig. 3. Brush-tufting Machine

until the drill is clear of the wood strip being drilled. The holes drilled in the strip do not go all the way through, as is generally the case with brush backs, for reasons that will be explained later.

A clearer idea of the working of this drilling machine will be obtained from the details in Fig. 2, in which the letters correspond to those in Fig. 1. It will be seen from this that, if necessary, the stroke of the feeding pawl can be changed by shifting the position of the block *K*. The depth of the drilled hole is, of course, obtained by the setting of the drill in the chuck.

Putting in the Bristles

The bristles are inserted in the drilled strips in the machine shown in Fig. 3 generally called a tufting machine. The

strip is placed in a carrier similar to the one on the drilling machine, but with the drilled holes up, and wedged in with wooden wedges as shown at *A* and *B*. The ratchet-toothed rack *C* is exactly the same as that on the drilling machine, the two having been cut at the same time, so that in feeding the strips under the plunger of the brush machine, the holes would register accurately with the punch used to insert the bristles. This is very important as otherwise the strip would be split and ruined.

The feeding motion is given the carrier in practically the same way as in the previous case, though the feeding is done on the return stroke in this machine and the carriage motion is given by means of a cam wheel *D*, instead of a crank, a bar *F* with a roller on one end, fitting the cam groove, being fastened to the carriage. The cam wheel is driven by sprockets and chain from the main pulley of the machine.

As the strip is fed along, a bunch of bristles is forced into each drilled hole and clinched in place by a short piece of stiff wire, drawn from the reel *F*. The action of the machine is more clearly shown in Fig. 4, the lettering being the same for both halftones.

The bristles used are held in the magazine *G* and are kept pressed toward the punch by a sliding piece *H* operated by cords and a weight. The punch which forces the bristles into the wood strip is operated by the cam wheel *I*. This cam also operates the bristle carrier *J* and the shears for clipping the wire. The wire feeding is worked by the cam wheel *K* which operates a pawl *L*, engaging a ratchet on the roller *M*.

As the machine works the bristle carrier moves through a short arc, seizes the right number of bristles and carries them under the punch. At the same instant the wire is fed in over the middle of the bunch of bristles, then the ram descends, clips off a short section of the wire and a punch descends between two guides, forcing the wire and doubled bristles to the bottom of the drilled hole. The act of forcing down the wire causes it to embed in the sides of the drilled hole and hold the bristles firmly in place.

A rear view of the machine is shown in Fig. 5, the cover of the bristle magazine being thrown back so as to show the bristles at *A*.

Building up the Cylinders

The wooden disks around which the brush strips are fastened, are made of two pieces of wood, glued together with the grain at right angles. These rough disks have a hole drilled in the center and are then taper reamed as shown in Fig. 6.

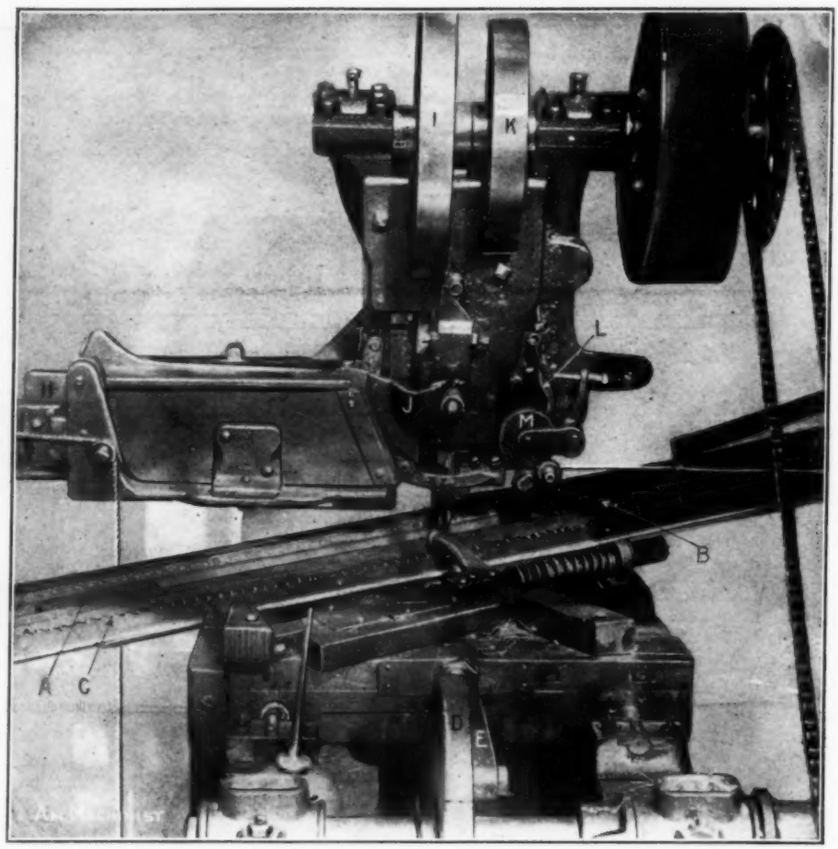


Fig. 4. Front View of Tufting Machine

Fig. 6. Cylinder-disk Reamer

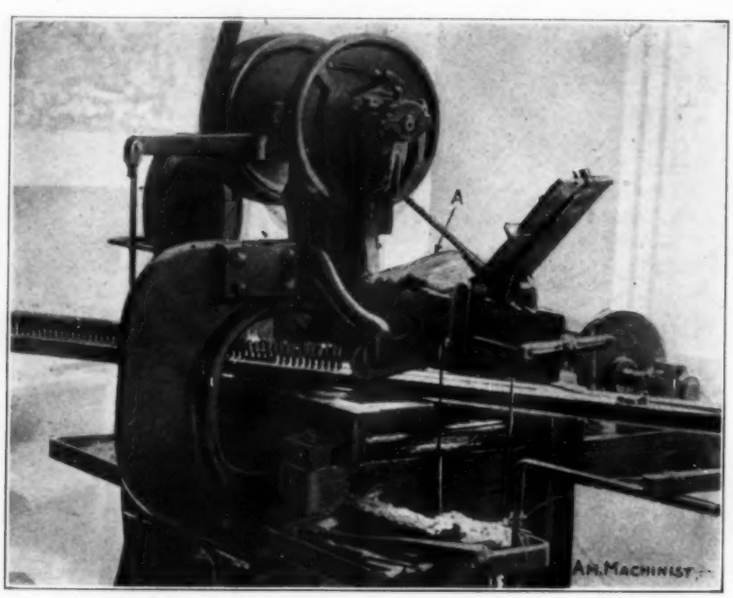


Fig. 5. Back View, Showing Magazine Cover Raised

In this machine the wooden disk is held at *A* on the bracket *B*, the lever *C* being held up almost parallel with the clamp *D*. As the lever is pressed toward the clamp, the end *E* of the lever *C* slides on the piece *F* forcing the lower end of the clamp outward and bringing the points *G* against the disk, holding it firmly against the bracket. The foot lever *H* is next pressed down and the revolving taper reamer *I* is fed into the hole in the disk as far as the stop will allow.

By using the peculiar clamping lever shown here, a very firm hold is obtained on the work with but little exertion on the operator's part.

Assembling Disks on the Shaft

The method of placing the reamed disks on the brush shaft is shown in Fig. 7. The work shown here is not intended for brushes but for wooden cylinders, yet the method illustrated is the same, though in the cylinder brushes iron spiders are screwed to the end disks.

In using the device shown, the right number of disks is strung on the shaft, and the shaft is placed between the centers at *A* and *B*, the latter being adjustable by means of the handwheel *C*. The disks are so distributed along the shaft that each may be set against one of the spacing brackets *D* which are previously correctly set. Glue-covered wedges are next driven into the taper hole of the disk around the shaft as shown at *E*. Next the shaft is placed in a lathe and the disks turned to size.

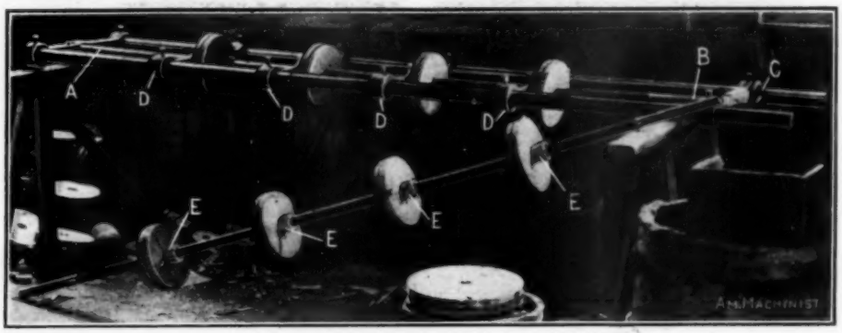


Fig. 7. Method of Building Up a Cylinder

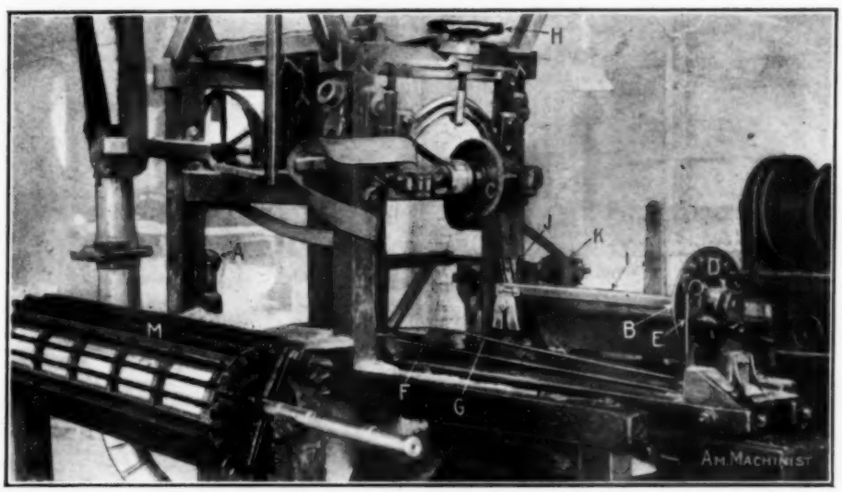


Fig. 8. Disk-slotting and Brush-trimming Machine

Slotting for the Brushes

After being assembled on the shaft and trued up, the disks are slotted for the brush strips in the machine, shown in Fig. 8, the shaft being placed on the dead center *A* and the indexing center *B*. The slots are cut with a dado saw *C*, the table being shoved along by hand. After the slots for one strip have been cut, the disks are indexed one division and the next set cut in the same way. The index plate *D* is locked in position by the spring *E* which carries a pin fitting the holes in the plate.

This machine, like many of the others in the factory, is built almost entirely of wood, the table being trussed at *F* and *G* to counteract the spring caused by work in the centers. The saw may be raised or lowered by turning the handwheel *H* which works the yoke to which the bearings are bolted.

Trimming the Bristles

When the disks have been slotted, the cylinders are fitted up and the brush strips put in place. Next the bristles are trimmed by again placing the shaft on the centers *A* and *B* of the slotting machine. The rest *I* is now used to guide the strips as the table is shoved along, and the bristles are trimmed to a uniform length by the revolving shear *J*, run by the belt and pulley *K*.

The shear consists of a piece of steel set crosswise on the shaft carrying it, and so ground as to present two edges

Fig. 9. Brush-balancing Machine

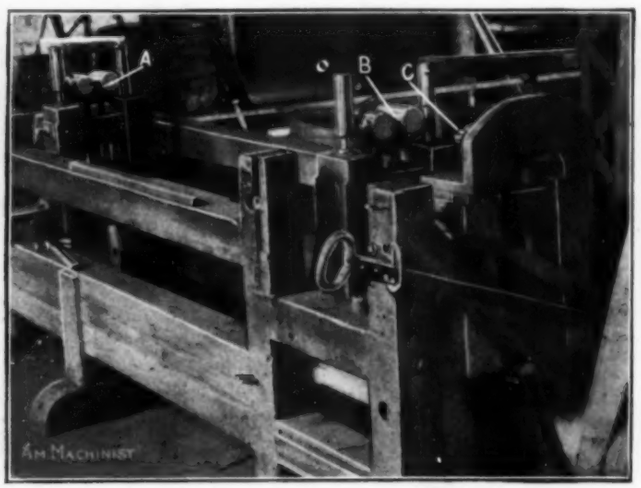


Fig. 10. Machine with Brush Removed

to a stationary blade set at *L*. As the shear runs at a high speed, the cutting action is practically continuous, and the brush strips, one after another, are all trimmed alike, the finished cylindrical brush looking as shown at *M*.

Balancing the Brushes

The trimmed brushes, which in practice run at about 1500 r.p.m., are given a running balance at a speed of 2500 r.p.m., in the machine shown in Fig. 9. This same machine with the brush removed is shown in Fig. 10.

There are three sets of roller bearings at *A*, *B* and *C*, the set *C* being used in order to provide a set on each side of the pulley. These roller bearings are made so as to give considerable flexibility of movement. The machine gives very satisfactory results, and was suggested by an article in the American Machinist, describing the Norton balancing machine.

Making Spiked Cylinders

Several kinds of wooden drums or cylinders are used in the various types of cotton-working machinery, some of them being spiked with steel pins. These drums are made of wooden disks wedged onto a shaft, as shown in connection with brush making, around which fitted strips of wood are nailed and turned true.

The cylinders are drilled for the spikes, in the machine shown in Fig. 11. This machine has 20 spindles, though in the present instance only 17 are being used for drilling purposes. The brackets *A* and *B* support the cylinder shaft, and a pulley *C*, with holes drilled in the rim for indexing purposes, is fastened on the shaft with a setscrew. An arm *D* bolted to the bracket *B* carries an indexing pin which fits the holes in the pulley *C*.

The table to which the brackets *A* and *B* are bolted is fastened to the vertical guides *E* and *F* by bearings, so that it will slide up or down on them. The lever *G* is pivoted at *H* so that if the outer end is pulled down by pressing down on the lever *I*, to which it is fastened by the connecting-rod *J*, the table carrying the cylinder will be raised and all the holes in one row drilled at once. It is, of course, to be understood that a similar set of levers is placed at the opposite end of the table. It may also be added in explanation, that the end of the lever *I* was broken at the time the picture was taken, a foot treadle being generally used.

The spikes are set into the drilled holes in the cylinders, as shown in Fig. 12, being started with a hammer and then all driven in to an equal depth with the spike set, shown at *A*.

An Automatic Drilling Machine

A machine used for drilling spike holes in a strip, used to make a comb-like device, is shown in Fig. 13. The strip to be drilled is placed at *A* and held in position by the clamp *B*, the holes being drilled at an angle as shown.

This machine differs considerably from the brush-back drilling machine already described. The drill spindle *C* is mounted in the bearings *D* and *E* on the car-

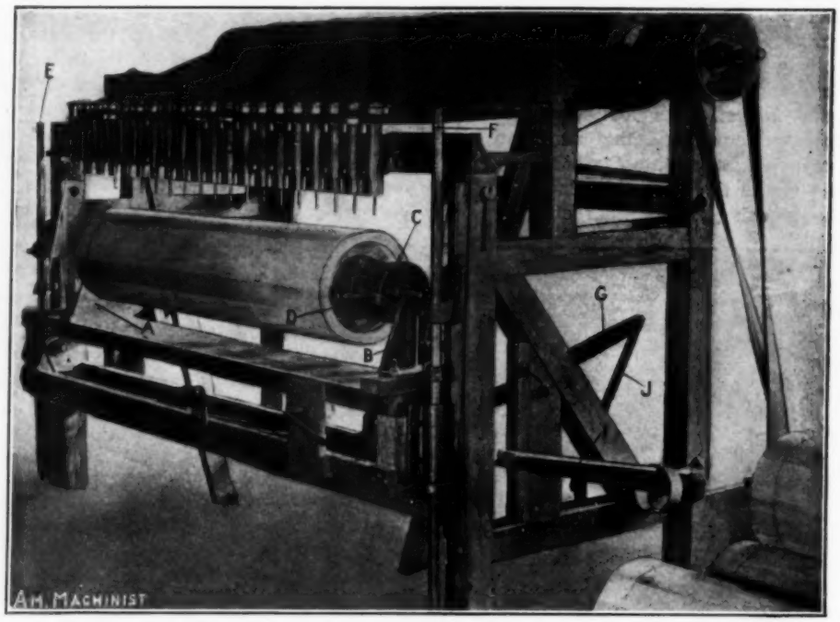


Fig. 11. Machine for Drilling Spike Holes in Cylinders

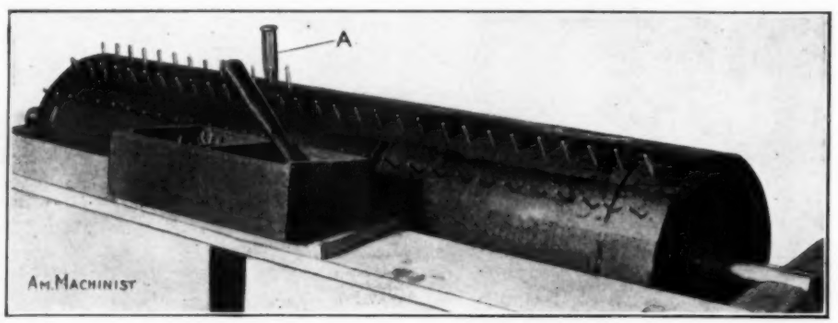


Fig. 12. Method of Setting the Spikes

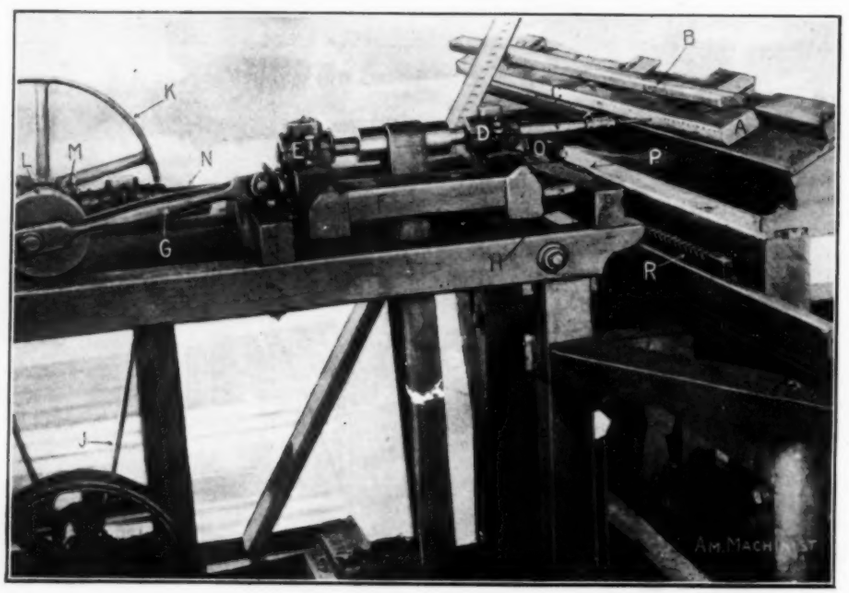


Fig. 13. Another Automatic Drilling Machine

riage *F*, and moves to the work, being operated by the connecting rod *G*, which gives it a reciprocating motion on the guides *H*. The drill spindle is run by the belt *I* and the crank operating the drill carriage is run by the belt *J* and the pulley *K*.

A bevel gear *L* is also placed on the same shaft with pulley *K*, and this gear meshes with the gear *M* and runs the shaft *N*. The opposite end of this shaft carries a crank disk *O*, on which is the pawl *P*, engaging the ratchet-toothed rack *R*. This feeding mechanism is so timed that the carrier, holding the strip to be drilled, is fed along when the drill spindle is on the back stroke after it leaves the wood. The spikes are put in the drilled strip in the same way as they are in the cylinders.

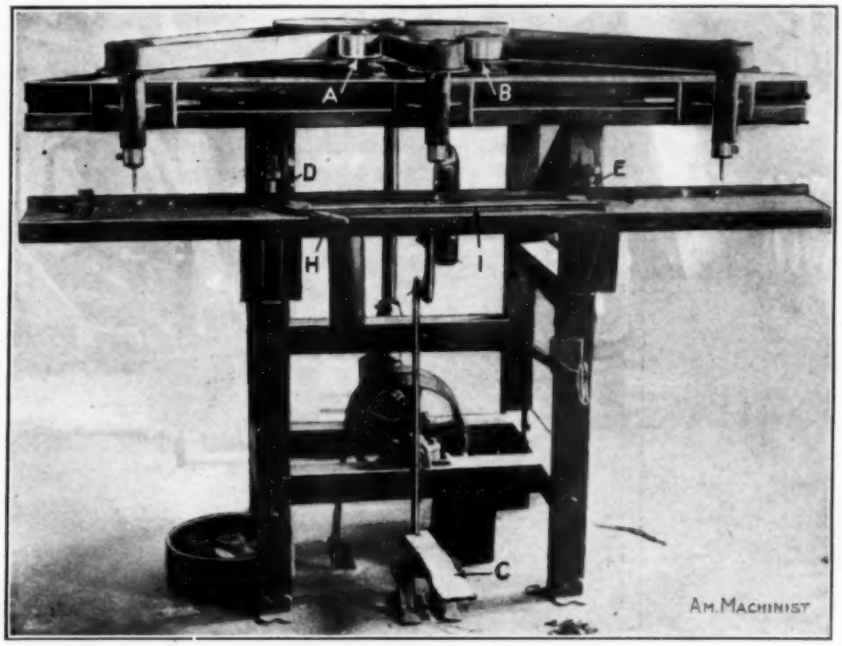


FIG. 14. APRON-STRIP DRILLING MACHINE

A THREE-SPINDLE DRILLING MACHINE

A special three-spindle drilling machine used for drilling apron slats, is shown in Fig. 14. The three spindles are adjustable lengthwise of the table, the change in belt tension being cared for by the two adjustable idlers *A* and *B*. The table is raised, so as to carry the work to the drills by means of the foot lever *C*, guides for the table being provided at *D* and *E*. The work is clamped to the table by the two eccentric levers *F* and *G*, both of which are worked at once by the handle *H*, a rod *I* connecting the two.

A BELT PERFORATOR

Aprons used for conveying purposes in some of the cotton machines are made up of strips, or slats of wood, drilled as just described, which are held together by leather belts to which they are riveted. The holes for these rivets are made in the belts by the machine shown in Fig. 15.

The belt *A* is fed in under the spring stripper *B* and is drawn along by the corrugated roller *C*. As the belt is fed along it is perforated at regular intervals by the spinning, awl-like tool *D*, which is given its up-and-down movement by the cam *E* in contact with the roller *F* on the spindle bracket. The spindle bracket and roller are held up against the cam by a lever *G* and the spring *H*.

A crank *I* on the end of the driving

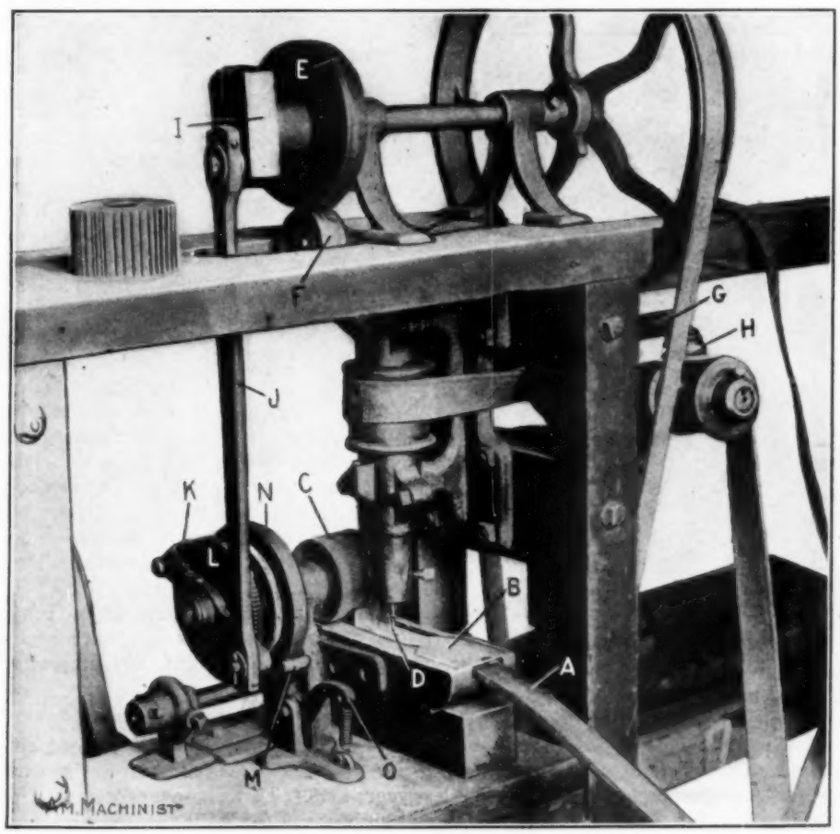


FIG. 15. APRON-BELT PERFORATOR

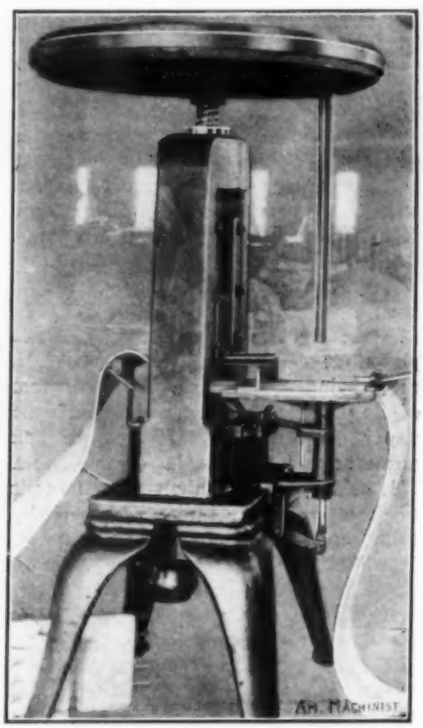


FIG. 16. HAND-OPERATED SCREW PRESS

shaft, works a connecting rod *J*, and operates the pawl *K* in contact with the ratchet wheel *L*. This mechanism works the corrugated feed roller and moves the belt along the correct distance at each stroke of the perforator.

A brake *M* is forced against the rim of the wooden disk *N*, by the lever and spring *O* and prevents movement of the feeding apparatus, except when it is pulled around by the pawl lever.

Making Distributor Belts

Belts used to carry the cotton to the various gins of a set are made of heavy five-ply, light-weave cotton, with spikes and sweepers, or flights, attached at intervals.

In attaching these spikes and flights, no holes are punched to weaken the fabric; but the mesh is spread and the spikes thrust through without injuring the belt. The holes for the spikes and flights are made in the hand-operated screw press shown in Fig. 16. The method of inserting the spikes is shown more in detail in Fig. 17.

In this halftone two of the spikes used are shown at *A* and one of the flights at *B*. The flight to be set into the belt is placed at *C* and the holder closed, a catch being shown at *D*. Then the ram of the press is run down and holes in the upper die force the fabric of the belt down around the shanks of the rivets. This holder also holds the spikes, the ends of the spikes being inserted in the holes at *E*, and the holder closed as before. However, the holder must be shifted for the different jobs, as the shanks of the spikes are single and offset, while the flight rivet shanks are double.

The method of shifting the holder is shown at *A*, Fig. 18. The method of raising the belt out of the operator's way, so that he can place the spikes, or flights, under it is also plainly shown. A plunger *B* carries the spacing device and at the lower end of the plunger is a counterweighted lever *C* which forces the whole apparatus up as the ram of the press rises.

The spacing of the belt for the rivet shanks is accomplished by setting the movable spring clamp *D* in the position shown, and then drawing the belt through till this clamp comes in contact with the cross-piece *E*, the operation being repeated for each set.

Riveting

A short distance back of the press is a riveting machine, so that when the operator has run out a good length of belt, as indicated, he places washers over the shanks and spins on the heads in a Grant riveter, as shown in Fig. 19. While riveting, the belt rests on the holder *A*, which is made so that it will slide out or in, or to the right or left, as the operator faces the machine, thus bringing the shanks easily under the riveting head.

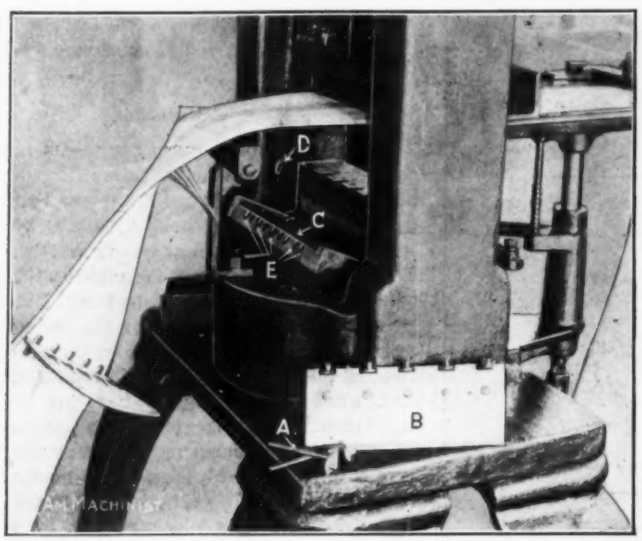


Fig. 17. Details of the Spike and Flight Holder

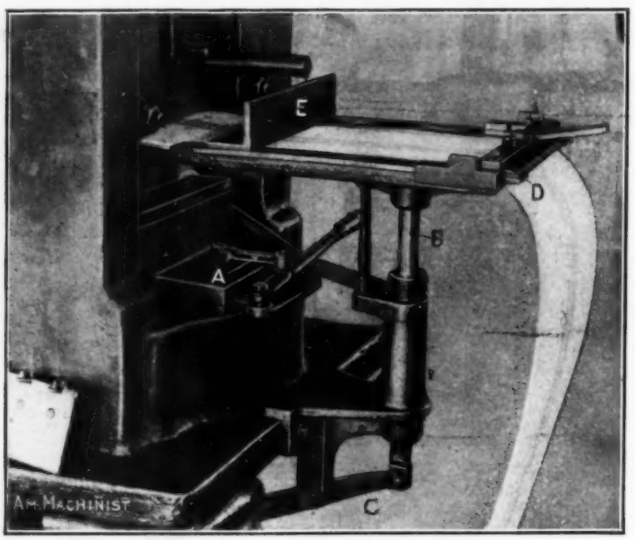


Fig. 18. Details of Holder-shifter and Belt Spacer

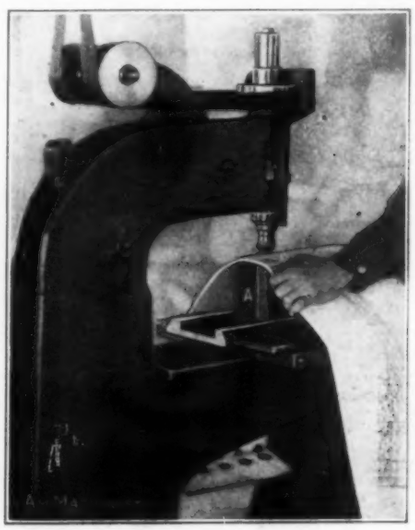


Fig. 19. Spinning Heads on Rivets

A Fireproof Floor Composition

A consular trade report states that extensive use is being made in Germany of a flooring composition, consisting of a solution of chloride of magnesium to which pulverized magnesium added, together with considerable proportions of sawdust, provides an inexpensive and fireproof flooring.

Those familiar with the flooring say that there is neither expansion nor contraction of the material from any cause whatever after a flooring of magnesum chloride is once laid. The very ingredients are such that there is no buckling or cracking due to heat or cold. In Hamburg the composition is mixed and spread where the building operations are being carried on, the prepared dry meal being delivered in bags from the factory and the lye water made on the spot.

It is impossible to state the precise rule for the composition of the meal or for the lye solution, these being the manufacturer's secrets and each manufacturer claiming particular merits for his own formula. These formulas are not patented, and there is no doubt that they are all substantially alike.

One composition claims to be crack free under all circumstances, warm under foot, elastic, soundproof, and preferable to linoleum.

The smelting and refining of lead employed 7424 wage earners during the year 1909. This showed a decrease of 10.8 per cent. over the number employed during 1899.

An Immense Drafting Organization

By J. D. Mooney

The important features of organization and an outline of the system of one of the largest drafting departments in the world—that of the General Electric Co., at Schenectady, N. Y.

How the efficiency of the department is maintained at a maximum.

The drafting department of the General Electric Co. is probably the largest in the world. The preparation of the drawings used in the manufacture of electrical apparatus at Schenectady, N. Y., is a great industry in itself, an industry employing over 750 people, including 500 draftsmen and 250 stenographers, clerks, apprentices, etc.

The nature of electrical work demands an enormous amount of drafting on account of its complexity and variety and the continual changes in the apparatus being produced. During the year 1911 there were 29,432 new drawings made at Schenectady, 34,712 drawings were changed, 9106 new small-part drawings were made, 5678 small-part drawings were changed, and 514 drawings were retraced. About 60 per cent. of these drawings were 12x18 in.; the rest ranged in size from 48x36 in. to letter size.

FIG. 1. ONE OF THE DRAFTING ROOMS OF THE GENERAL ELECTRIC CO.

THE ORGANIZATION

This great production of drawings is directed by an engineer in charge of drafting, his assistant, 15 foremen, and 13 assistant foremen. The organization of the drafting department is extremely flexible. It is laid out along certain well defined lines, but owing to the complexity of the work, it is necessary frequently to disregard the lines of the organization and allow freer intercourse between the draftsmen and engineers.

The men in charge of the larger groups of draftsmen are called supervising foremen. Smaller squads within these large groups are in charge of assistant foremen, there being in some cases as many as three assistant foremen under a single supervising foreman. Then there are small squads in charge of foremen who report directly to the engineer in charge.

The contact of the engineers with the drafting department is made not only with the engineer in charge, but also directly with the supervising foremen, assistant foremen, and even with the draftsmen themselves; the line of contact is followed that seems best to facilitate the work.

An organization employing 750 people requires a vast amount of work on the part of the engineer in charge. He hires all of the employees, fixes their rates, and discharges employees on the recommendation of the foreman. He handles all of the correspondence relating to the general affairs of the drafting department. Beside his executive duties, the engineer in charge has an immense amount of consulting work to do in connection with the daily problems in the various divisions.

At varying intervals the engineer in charge calls the various foremen working under him together for a discussion of the progress of the work. Any suggestions the foremen have to make for facilitating the work are carefully heard, and are discussed in open meeting by the other men. The suggestions are either adopted or they are laid on the table because of objections raised by some of the members of the conference. No effort is made to have these meetings recur regularly, but they are held just as often as seems to be warranted by the suggestions available.

MECHANICAL STANDARDS COMMITTEE

A mechanical standards committee of eight members has general supervision

of the mechanical design of all the apparatus and the specification of the materials used in the apparatus. Numerous tests of materials are made under the direction of this committee to determine accurately the physical characteristics of the materials for the purpose of developing empirical formulas to govern the design of the apparatus.

This committee is made up of the mechanical superintendent of the Schenectady works, the superintendent of one of the large manufacturing sections at Schenectady, the mechanical superintendent of the Lynn works, the mechanical superintendent of the Pittsfield works, a mechanical engineer of the Lynn works, two mechanical engineers of the Schenectady works, and the engineer in charge of drafting at the Schenectady works.

The mechanical standards committee has developed and tabulated mechanical standards for very many features of the apparatus, including bearings, gear covers, washers, springs, bolts, screw threads, pulleys, belts, etc. Wherever these standards have been set by the committee they must be strictly adhered to by the designing draftsmen, unless the requirements of the apparatus seem to demand a variance from the standards. In this case, the designer brings the exigency to the attention of the chairman of the standards committee, who authorizes the change if he deems it expedient.

The variation is brought to the attention of the committee at large at its next meeting for its decision as to whether the departure shall be incorporated as part of the standards already set. This committee also passes finally on all suggestions for changes in the general design of apparatus.

The standards adopted by the committee are tabulated, and every division of the drafting department at the company's various works keeps on hand an uptodate file of the standards adopted. The tables are struck off on blueprints. These blueprints are made up in sets in book form for the use of the various drafting divisions.

Committee on General Drafting Practice

A committee on general drafting practice is made up of the four engineers in charge of drafting at the company's various works, Schenectady, Lynn, Pittsfield and Erie. This committee establishes standards of delineation and publishes a book containing the authorized practice.

This book places in the hands of every draftsman the following features of delineation: Standard sizes of drawings; margins; the angle of projection (the

Fig. 2. Blueprint Room—Printing Frames

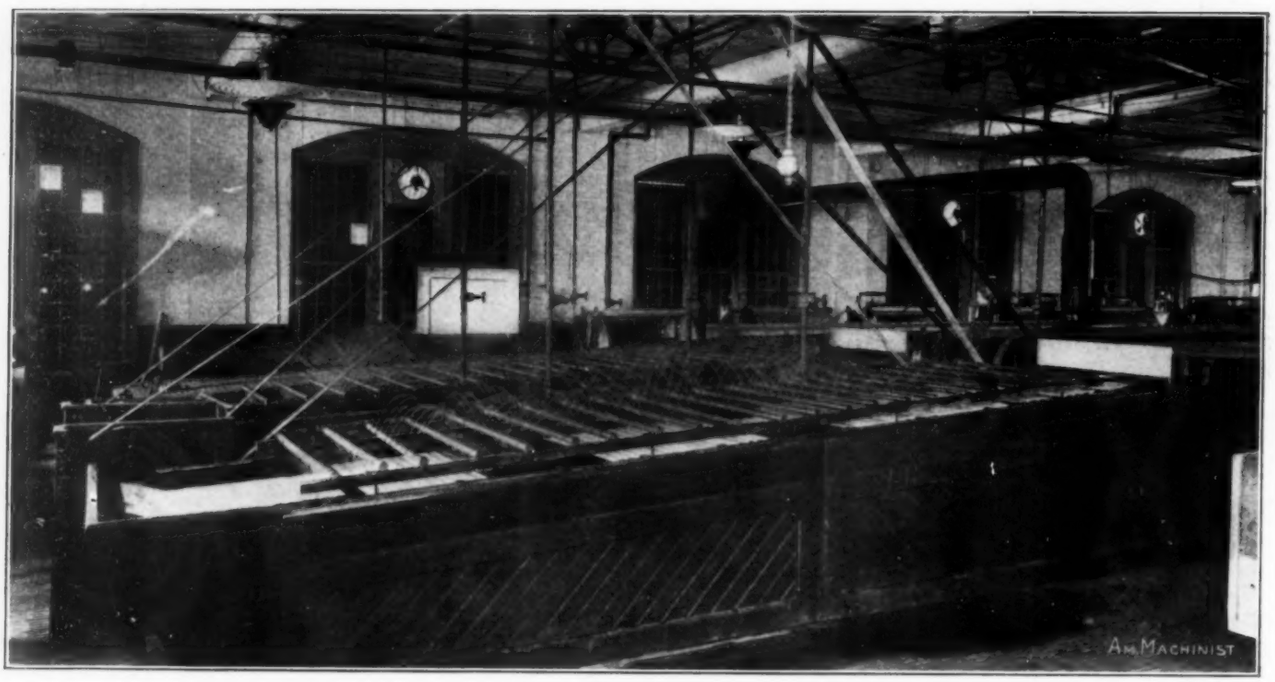


Fig. 3. Washing and Drying Apparatus, Washer End—Blueprint Room

third angle is always used); methods of dimensioning; abbreviations (abbreviations are used only where lack of space prevents the use of the complete word); the title forms and writing; lettering; lines; and standard cross-sections (cross-sections are used exclusively in assemblies, which are made only in special cases). A few other details that apply very generally are also included in this book, such as dimensions for pressing fits, running fits and limits.

Extreme Specialization

Probably the most remarkable feature of the immense drafting department is the extreme specialization that is carried out in all of the work. The department is divided into divisions, according to a general classification of the apparatus, and in each of these divisions the work is subdivided so that groups of men or individuals can specialize in particular lines. A man is given some particular class or piece of apparatus and enabled to familiarize himself thoroughly with it.

The draftsmen do no calculating. A man in each division calculates all of the stresses. Most of the details in connection with the parts of the apparatus are already designed and tabulated. The draftsman has only to pick out the right combination of parts to fit the electrical specifications.

An underlying principle of the system is to make it possible for a draftsman to spend a maximum of his time drawing; any of his time spent in clerical or other like details is unprofitable. A designer never does any detailing or tracing, a great deal of which is done by the apprentices. A man is kept on a quality of work that will justify his salary.

Fig. 5. Apprentices in Class of Mechanical Drawing

Specialization in Weight Calculations

Some very interesting work is done in connection with the calculation of weights for the various machines and parts. The draftsmen do not calculate the weights on their drawings, but turn over this class of work to a special division. Four men are employed in this division and spend all of their time just on these calculations. Naturally, they become very proficient in this work, and also very accurate; almost all of the weights are calculated to within 4 per cent.

If the part to be calculated is irregular, it is plotted to scale from the blueprint furnished by the draftsmen for whom the calculation is being made, and from the accurate layout of the piece the

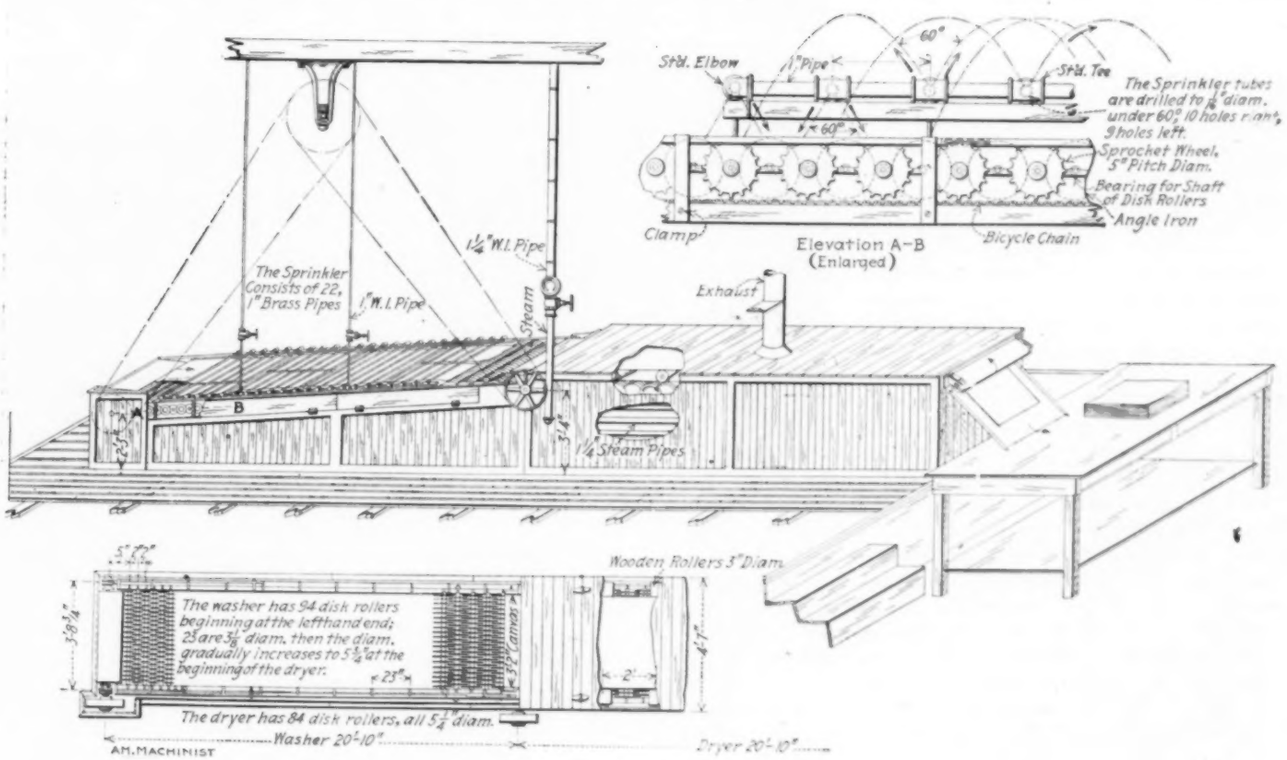

Std. Elbow
1" Pipe
60°
Std. Tee
The Sprinkler tubes are drilled to 1/16" diam. under 60° 10 holes right, 9 holes left.
Sprocket Wheel, 5" Pitch Diam.
Bearing for Shaft of Disk Rollers
Angle Iron
Clamp
Bicycle Chain
Elevation A-B (Enlarged)
1 1/4" W.I. Pipe
The Sprinkler Consists of 22, 1" Brass Pipes
1" W.I. Pipe
Steam
Exhaust
1/4 Steam Pipes
Wooden Rollers 3" Diam.
The washer has 94 disk rollers beginning at the left hand end; 23 are 3 1/8" diam. then the diam. gradually increases to 5 1/4" at the beginning of the dryer.
The dryer has 84 disk rollers, all 5 1/4" diam.
Washer 20'-10"
Dryer 20'-10"
AM. MACHINIST

Fig. 4. Some Details of the Blueprint Washing and Drying Machine

areas of the various surfaces are determined by means of a planimeter. The sum of these areas is multiplied by the average thickness of the piece and the necessary factors of unit weight and scale are introduced to complete the calculation for the total weight.

Of course, for parts that become more or less standard in shape and dimensions, such as bearings, bedplates, etc., tables are calculated and put into form for ready reference.

The weights calculated by these specialists are employed in a great many ways. The purchasing department of the company makes a very important use of them in checking up castings bought at a price per pound. The weights are also furnished to customers who buy heavy machines, as the weight is a factor in the building of a foundation.

The Inspection Division

The inspection division is responsible for the smooth running and effectiveness of the system. It is in charge of a chief inspector, who is at the head of a bureau of assistants, clerks, stenographers, etc. Under the chief there are several inspectors, one in each drafting division. These inspectors do not answer to the foremen in charge of the divisions, but directly to the chief inspector.

Experience has taught the management of the drafting department that a great deal of harm can be done by disregard of some of the features of the system that seem unimportant to the draftsmen, or to the foremen of the divisions; therefore, the division of inspection was created to maintain the uniformity of the work.

The inspection division operates a checking system by means of which the duplication of drawings or parts is prevented. This applies especially to the die work, screw-machine work and standardized products. If a draftsman is to design some apparatus, he first finds out through the inspection division whether anything similar has been done before, and in this way sometimes saves considerable expense by taking advantage of existing drawings.

The Course of a Drawing

The course of a drawing through the drafting department is as follows: The request for the drawing comes from the engineering department, either in the form of a sketch or written technical details. These details usually cover only the electrical characteristics of the apparatus; the proper mechanical design is adapted by the drafting department. The request is handed to the division of the drafting department connected with the department of the works that will manufacture the apparatus. The foreman gives the drawing a number, sets of which, in lots of one hundred, are furnished to him by the inspection bureau.

When the drawing has been completed, a white card with a corresponding number and title is filled out, and drawing and card are sent together to the chief inspector. When the drawing is received in the chief inspector's office, the white card accompanying it is stamped with the date and hour of receival and a yellow card corresponding to the white, and bearing the same number, is taken from a file and stamped in the same way. This yellow card is then filed numerically.

The white card is filed under a topical index. The yellow card is placed in a pending file at the time the foreman makes a request for the drawing number which the yellow card carries. The presence or absence of this yellow card in the pending file shows whether the drawing has been completed and passed through the chief inspector's office. From the chief inspector's office, the tracing is sent to the blueprint department, which makes duplicate blueprints at once, plus whatever prints are necessary for the requirements of the various shop departments interested in the work. One of the two prints referred to is filed in the main fire vault and the other, called the reference print, in the subvault of the division that made the drawing.

Whenever a drawing is changed, a card is filled out by the draftsman making the change, and sent along with the drawing to the chief inspector's office. The reason for the change and the disposition of material are specified by number, keys of which are furnished draftsmen. The object of these keys is to eliminate lengthy and involved explanations on the part of the draftsmen. A record of the changes made is carefully listed on the tracing changed, so that the pattern maker or others can quickly refer to these changes in comparing the changed product with the first forms.

When a draftsman changes a tracing, he must send in the reference print from which the tracing was changed. Then a new print is made from the tracing, as changed, and returned to the drafting department making the change. This insures that the reference print kept on hand in the subvault is uptodate.

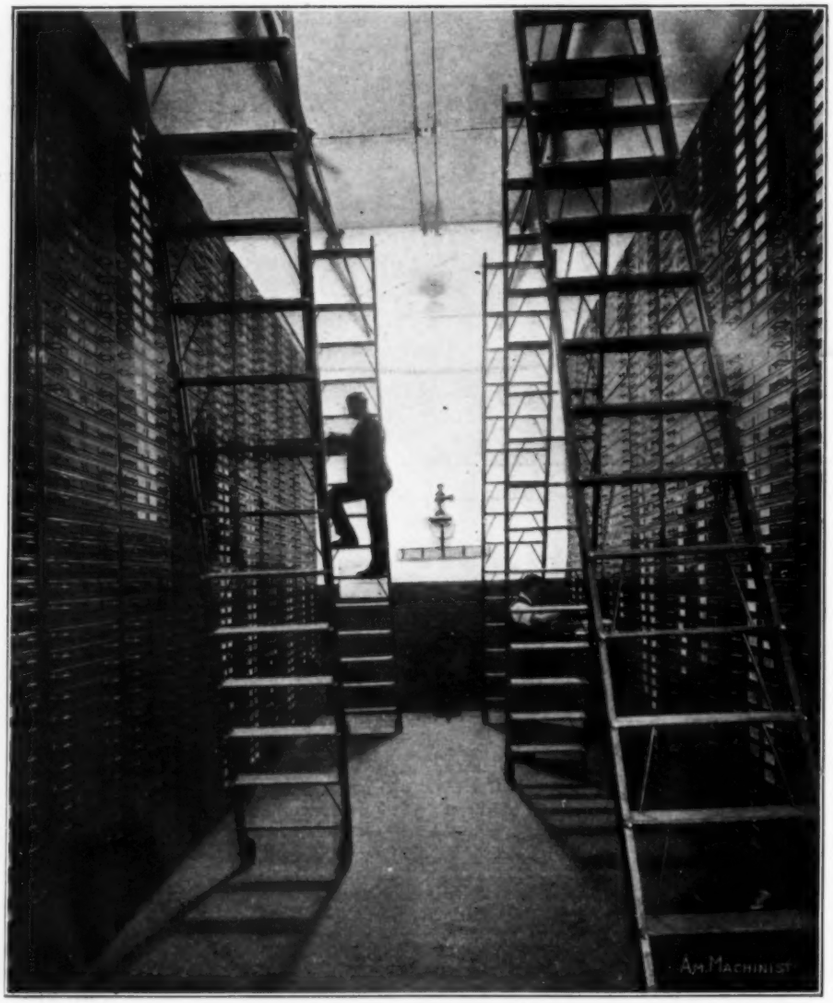


Fig. 6. One of the Subvaults Where the Tracings Are Kept

Sometimes when a piece of work is in a great hurry, the draftsman makes a sketch, supplying the pattern maker with enough details to go ahead at once with the work, instead of awaiting the completion of the regular drawing. Such sketches are made in a sketch book that retains the original; the carbon copy of the sketch goes to the pattern maker. These sketches are duly recorded, according to the numbers they carry, which are part of the regular numbering system.

An important work of the inspection department is the publication of a daily bulletin containing a list of the drawings that have been passed through the inspection division during the day. Every foreman throughout the works is supplied with the parts of the bulletin that will interest him. In this way the foreman is enabled to keep in touch with what drawings are going through, which is a great help to him in planning his work.

The Drawing List

The drawing list, as suggested by the title, is a complete list of the drawings that apply to a particular piece of apparatus. This drawing list is especially useful in the production department. The drafting department and the production department work hand in hand; in fact, a plan is now being tried whereby a production clerk is placed in each drawing division to further facilitate the coöperation between these two departments.

When a shop order goes to a department of the works, it is accompanied by a drawing list, attached to which is a material list containing all the necessary information and general instructions that the production clerk can supply. Very often no new drawings are necessary for a shop order specifying apparatus. It is possible simply to combine the drawings already made.

The Blueprint Department

Some idea of the immensity of the capacity of the blueprint department can be obtained from the fact that from eight to ten thousand blueprints are turned out daily. During the year 1911, almost two and a half million blueprints were produced. About 80 people are employed, the majority of whom are girls.

Of course, the methods of printing are automatic. There are employed in this work 13 stationary frames and 6 rotary frames, made by the General Electric Co., one blue-streak printing machine and one mercury frame, made by the Revolute Machine Co., of New York. There are three automatic washing and drying machines in the main blueprint department.

Besides the general department, an auxiliary complete equipment, including three blueprinting machines and one washing and drying machine, is maintained in a separate building. This substation handles a good deal of work turned over to it by the general department, and is also intended to have for its more important function an emergency service that can be relied upon in case some accident or other circumstance puts the main department out of use.

The machine for washing and drying the blueprints is shown in Figs. 3 and 4, which illustrate the general construction and more important details. This machine was developed by the General Electric Co., and has been in use several years. Some changes and improvements have been included in the design of the machine from time to time. One of these improvements is a wringer arrangement at the end of the division of the machine, given to washing the prints. the prints.

Before the prints begin their passage over the hot steam pipes, they are passed through two brass rolls, which squeeze out most of the water and wrinkles and give them a smooth finish. The blueprint is fed in at one end of the machine and passes over 21 ft. of washing space; it then passes through the brass rolls and onward to the drier, which is also about 21 ft. long. It takes about 10 minutes for a print to pass entirely through the machine. Upon emerging the print is perfectly dry.

The operations connected with the making of the prints are much simpler than the problems connected with their distribution. The system for taking care of the distribution of the prints is, in outline, as follows:

The request for prints, when it arrives at the blueprint department, is handed to the particular division of the department which takes care of the classification covering the request. There are several of these classifications in the distribution: the Schenectady factory division, the allied companies division, the purchasing department division, etc. A clerk in the division to which the request for blueprints is handed makes out an order on the vault for the tracing necessary to make the blueprints requested. Then when the tracing is received, a clerk makes out a slip specifying the quantity and kind of print to be made; this slip guides the printer. Finally, when the print is ready to send out, a record of it is made on a card, showing by symbols where it is to be sent and when. A receipt accompanies the blueprint to its destination and when returned, properly signed by the recipient, it is filed for possible future reference.

A feature of the blueprint department is its special-delivery system. When some prints are wanted in a great hurry, all the routine governing the production of regular prints is followed, but the special is given the right of way. These special rush prints are washed by hand and put through a hand wringer. Special-delivery prints are often delivered to some distant parts of the works two minutes after the order is received.

An interesting use of the blueprints is made by the company in connection with purchases. The purchasing department sends out a good many prints to companies from which material is being purchased, as a means of specifying the quality, dimensions, etc., of the goods purchased. The purchasing department simply states on its order that a blueprint is being sent to govern the purchase and a copy of this order is sent by the regular shop mails to the blueprint department for proper execution.

Mail Distribution

The problem of distributing and collecting tracings and blueprints to and from the various departments has been solved by a system of pneumatic tubes supplemented by errand boys. A station of the pneumatic-tube service at the central drawing and blueprint office connects with the headquarters of the pneumatic-tube system, which serves for the General Electric Co.'s mail service. From the headquarters, the tubes are relayed to four substations, from which distribution is further effected by means of errand boys.

The Drafting Apprenticeship*

Part of the apprenticeship system of the General Electric Co. is devoted to the training and developing of young men into efficient draftsmen. At present there are 106 boys taking the drafting apprenticeship; 48 of these are completing their first year; 25 their second year; 21 their third year and 12 their fourth year. As the boys in this classification do not start in squads, but singly, the quantities specified refer to the number of boys more or less advanced in the work of the year mentioned.

The course is of four years' duration; the first year is spent in the drafting room, on blueprint work and tracing; the second year is spent in the shop where the apprentice can gain a knowledge of practical methods in machine construction; and the two remaining years are spent in the drafting room.

The classroom work, which continues throughout the four years' course, is given during the regular working hours. The course in mathematics includes algebra, geometry, trigonometry and descriptive geometry. In the fourth year the apprentice is given elementary mechanical design and a short course in the physical testing laboratory, where he can make observations on the behavior of materials under stress.

The compensation is 7½c. per hour at the beginning of the course; this increases gradually until the fourth year, during which 18½c. per hour is paid. No

*For a complete description of the apprenticeship system of the General Electric Co., see Vol. 33, Part I, page 1 of the American Machinist.

application is considered where it is evident that the only consideration on the part of the applicant, his parent, or guardian, is the question of employment. The applicant must come well recommended, be between 16 and 18 years of age inclusive, be able to speak, read and write English and to pass an examination in common and decimal fractions, denominate numbers, square and cube root, mensuration, and the metric system.

The course is very popular and a great many more applicants are available than can be placed. A boy is not indentured until he has been on probation long enough to permit the superintendent of the course to judge of his ability and adaptability for the work. This probationary period lasts from 30 to 60 days. If it is decided that a boy cannot qualify for indenture, he is advised to drop the course, or to take some other apprenticeship course, for which he is better suited.

The drafting apprentice works directly under the direction of the foreman in charge of the drafting division in which he is placed. However, the superintendent of apprentices keeps in touch with all the different apprentices employed by making it a point to visit the different departments and to inquire into their progress.

The superintendent not only sees that the boys are fulfilling the requirements of the work but also tries to insure that the boys are receiving the necessary amount of attention from the foreman and his assistants in charge of other work.

The apprentice takes 4½ hours of classroom work weekly. As stated before this time spent in the classroom is taken directly from his working hours. The recitation periods last from an hour and five minutes to an hour and fifteen minutes. The work given in the classroom entails a certain amount of study and preparation at home, averaging from four to six hours weekly, depending upon the ability of the boy. The boys are advanced individually, and progress in the course depends entirely on the individuals themselves.

Just as rapidly as a boy completes a subject he advances to the next subject. However, he does not complete the course in less than four years, because just as soon as he has finished the prescribed work in the class room, he is given further advance work. Consequently, rapid progress on his part redounds to his advantage in that any extra work which he may be able to complete makes him a better journeyman draftsman.

Accurate records in detail are kept of each boy's work, showing his percentages in the studies taken, deportment, etc. Fully 90 per cent. of the boys who enter the course keep even or ahead of the scheduled studies. The parents of the boy are kept in touch with his progress in the work. Ordinarily, however, no report is made to them unless he is delinquent. If he falls behind in the work, his parents are advised and their assistance is requested in getting the boy to better his progress.

The superintendent of the apprenticeship course expressed his philosophy thus: "Boys will be boys, but boys will be men after a while. The boy is father to the man. If you don't make him the right sort of a father some day the man will blame the conditions under which he received his training. Most people consider boys a hard proposition, but a little study in each individual case will reveal the best way to handle the boy and make a good man of him." A "hard case" usually means to him only a type of misdirected energy which he patiently attempts to train to the proper direction.

Keeping the Supplies

All of the supplies, including pencils, erasers, thumb-tacks, etc., are furnished to the draftsmen from a central stockroom in charge of an attendant who keeps track of the supplies consumed by all the various draftsmen. It was found before this checking system was instituted that a good many of the draftsmen were inclined to be very careless in taking care of the supplies that were given to them. A case was cited of a young apprentice who used up seven hard pencils in a week. Now, if a draftsman is consuming too liberal an allowance of supplies, he is warned to be more careful. This stock-keeping system has proved itself well worthy of maintenance, as during last year, it is calculated, it saved between three and four thousand dollars.

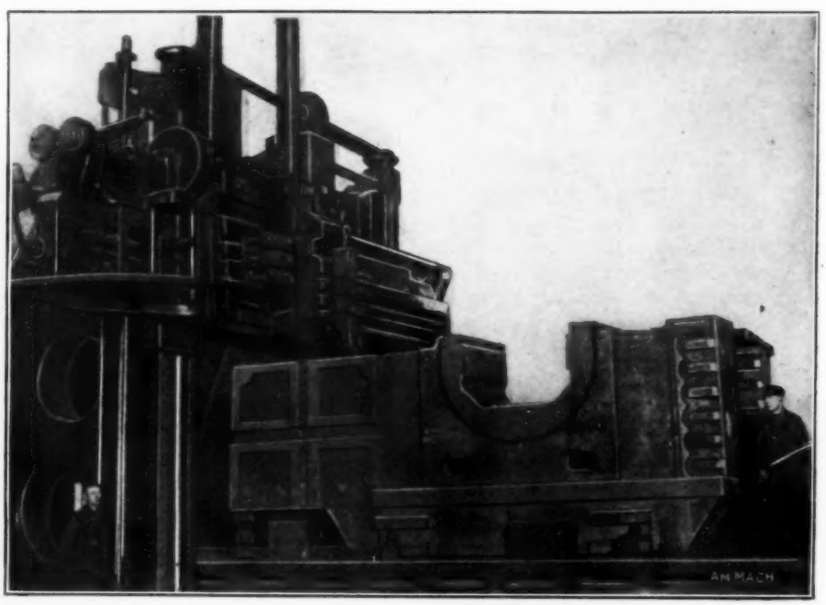
The Fire Vaults

For every tracing that is sent to the blueprint department by the inspection bureau in charge of the tracings on their regular course, two blueprints are returned to the inspection bureau for special purposes. One of the prints thus furnished is sent to the drafting division which made the tracing. This print is kept on file in the division to serve as means of reference by the draftsmen and engineers. When a change is made on the tracing this reference print must accompany the tracing to the inspection bureau to be exchanged for a new print from the tracing as it has been changed. In this way it is assured that only such prints will be on file for reference in the various divisions as have been made from the changed drawing.

The other print is sent to an isolated fire vault for a permanent record. This vault is of concrete and of the latest fireproof construction; the prints are filed in iron cases and racks; these are not permitted to leave the vault except on a duly signed and approved receipt in which the signer guarantees to return the print as soon as possible. Prints are also kept in this file from the company's Pittsfield and Lynn works. Besides the main vault, there are six sub-vaults for the distribution of reference proofs to engineers and draftsmen for consulting purposes.

Planing an Engine Bed on the Largest Planer

The accompanying illustration shows an engine bed 12 ft. 5 in. wide, 20 ft. long and 8 ft. 6 in. high, being planed on a Niles-Bement-Pond planer in the McIntosh-Hemphill shop, Pittsburgh, Penn.



Planing an Engine Bed on the Largest Planer

The planer, which weighs 845,000 lb. and is said to be the largest in the world, was described in detail in the American Machinist, at page 1, Vol. 31, Part 1.

A Review of Existing Wage Systems

By C. B. Auel*

This article defines and explains briefly the principal systems of wage payment now before the public and in more or less general use.

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The study of wage systems is as intensely interesting as any connected with a manufacturing industry, and each year witnesses renewed effort either to eliminate more or less obvious defects in existing systems or to develop more nearly perfect ones. While there will undoubtedly be general agreement with the inference contained in the preceding statement, that the ideal system has not yet been devised, there may perhaps be some exception taken to the further statement, equally true, nevertheless, that there are several wage systems already extant, which, when properly selected and impartially applied, will be found capable of fulfilling normal conditions very satisfactorily, leaving little additional to be desired.

It is the ever-variable human element, sometimes the employer, as often the employee, refusing to measure up to rational standards which renders it so exceedingly difficult to devise methods that will prove universally acceptable under all the conditions likely to arise.

Much of the difficulty is due, no doubt, to the common, though mistaken feeling that the interests of employer and employee lie wide apart; and until this situation is materially changed, there will always be a heavy handicap on every effort looking to the development of an ideal wage system.

The real interests of employer and employee are, as a matter of fact, identical. The legitimate aim of each should be to make a fair profit on the capital investment, represented in the case of the employer by his product and on the part of the employee by his labor. The employer desires low costs, the employee with equal fairness wants high wages. If these two features can be attained simultaneously, both parties should, and must be, fully satisfied.

It will be seen from the preceding that any real solution of the problem of the ideal wage system must bring with it correct answers to the two questions, "What constitutes low costs," and "What are high wages?" Both of these terms are open to considerable misconstruction and, therefore, in need of more clean-cut definitions. The present article does not attempt to go further into this phase of the matter, but is intended to define and explain briefly, the principal systems of wage payments now before the public and in more or less general use.

All wage systems may be placed in one of four groups: Daywork, piecework, premium or bonus work, and gain or profit-sharing. Among these discussed may be mentioned:

Daywork	Piecework	Premium or Bonus Work	Gain or Profit-sharing
A Hour	*A* Straight	*A* Halsey	*A* Towne
B Day	*B* Manchester	*B* Weir	*B* Miscellaneous
C Shift	*C* Taylor Differential	*C* MacLane Double Rate	
	D Group	*D* Rowan	
		E Cardullo Diminishing	
		F Gantt	
		G Emerson	
		H Santa Fé	
		I Group	

Daywork

Daywork is the oldest form of wage payment, mention being made in the Bible of how the laborer was content to work for a penny a day. A very large percentage of skilled and unskilled labor throughout the civilized world operates under this system. It will be observed further, especially in the larger concerns, whose product is more or less diversified, that even when some other form of wage system has been introduced, there will still be a considerable portion of the labor paid by the hour, day or shift.

Under this method, the quantity of work to be completed in any given time is not specified; moreover, the hourly rate is the same, regardless of the number of hours worked in a day. Expressed as a simple equation,

Hourly Rate × *No. of Hours* = *Wages.*

Chart 1 has been plotted to show this relation. Daywork, therefore, offers no inducement for any increase in output over a recognized basis; the natural tendency in consequence must be for the average workmen not to exert themselves further than to turn out just sufficient work as will, in their own estimation, satisfy their immediate superiors and so insure retaining their jobs. From the fact that no time or piece is stipulated for the completion of a piece of work, it has been argued that the quality should be of the highest, and in theory this may be true.

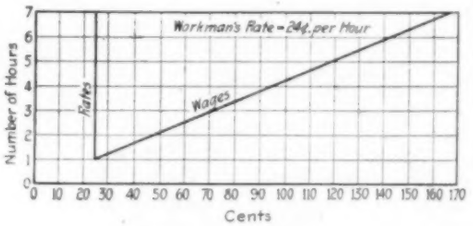


CHART. 1. DAYWORK

CHART 2. STRAIGHT PIECEWORK

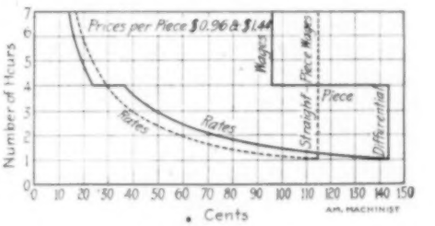


CHART 3. DIFFERENTIAL PIECEWORK

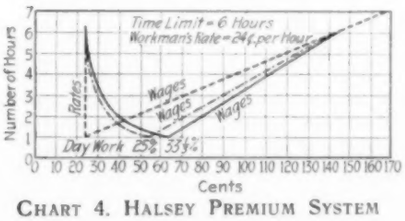


CHART 4. HALSEY PREMIUM SYSTEM

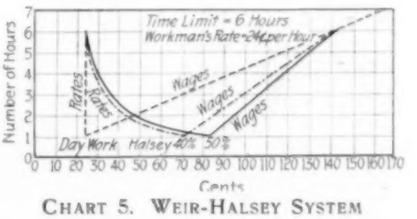


CHART 5. WEIR-HALSEY SYSTEM

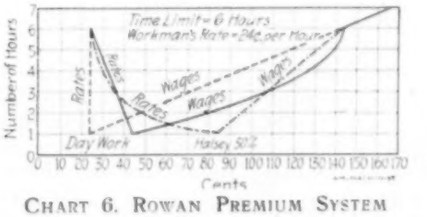


CHART 6. ROWAN PREMIUM SYSTEM

In many shops, working under so called "scientific management," and where an "incentive" is offered to the workmen to put forth extra effort to increase their output, it is the practice to maintain records of productive labor efficiencies either of the individual workmen in a department or of the department as a whole, efficiency being considered as the ratio between the time actually taken on a job and the time each job should take.

For example, if 12 hours were actually taken to do a job and 10 hours had been set as the time in which the job should be done, then the efficiency of the workman doing this particular job would be set down as 83⅓ per cent. If, however, it were a job on which no time had been set in which it should be done, possibly because it was quite special and not likely to repeat itself, and the work was done by daywork in 12 hours, the efficiency would be arbitrarily figured at 65 per cent., or even lower. In this case it is assumed that the job could have been done in 7½ hours had an "incentive" existed to do it in such time.

This, then, is an indication of what authorities on the subject think of daywork, as compared with other systems of wage payment. It follows from what has been said, therefore, that under daywork, increased output can be obtained as a rule only by increased supervision, and under it the cost per piece must accordingly be more expensive than under any other form of wage system. Notwithstanding this, it is, in many cases, the only logical one to use; as, for instance, in work such as die, template, jig or pattern making, where no two pieces are in any wise alike, and where it would be impossible to determine within accurate bounds without the expenditure of a prohibitive amount of labor, either piece prices or premium time limits.

From the accounting standpoint, daywork is less complicated than any other form of wage system, as far as figuring the payroll is concerned; but, in the matter of figuring costs, it is not so simple as piecework, though rather more so than premium work.

Straight Piecework System

Straight piecework is the second oldest form of wage system. Payment is based solely on the piece, as its name implies, and since the time employed is not specified, it will be seen to be the very opposite of daywork. Since it is only ranked by daywork in the matter of age, it is without doubt next to it the most commonly used method. The wages earned may be written,

$$\textit{Piecework Price} \times \textit{No. of Pieces} = \textit{Wages.}$$

Chart 2 shows that the price per piece is the same, regardless of the time employed. It will, however, be observed that the wages or the hourly rates of the workmen increase with decrease of the time taken, thus indicating one way in which the employee may receive higher and higher wages on his labor. At the same time the employer will obtain lower and lower costs in his product, for while the price per piece undoubtedly remains the same, the output in unit time increases, thus lessening all indirect expense, such as supervision, heat, light, water, etc.

For the reason that the workmen take all of the direct profits, the employer not sharing them as in premium work, but being restricted simply to the indirect profits by a reduction of indirect expense, the application of piecework is confined to rather narrower fields than would otherwise be the case. Obviously the employer cannot be expected to use this system in connection with work in which details have not been thoroughly standardized, and in which there would be possibilities of error in the setting of piecework prices.

It may, of course, be argued by some that errors are easily rectified by "cuts" in the prices if too high; since, if the prices are too low, the workmen insist that they be raised. The indiscriminate cutting of piecework prices, due to the loose and unscientific way in which they have been set in the past, has undoubtedly been the cause for much of the abuse heaped upon the piecework system, to which it is hardly entitled.

Regardless of the logic involved it has been demonstrated that for best results low prices must be raised, but high prices should not be lowered unless the method of making the piece is changed, in which case a revision in price is permissible. An argument that has been advanced against piecework in common with all other wage systems having an 'incentive," is that the increase in production is likely to be accompanied by a decrease in quality. While this tendency undoubtedly exists, it can and is effectually guarded against by a properly enforced scheme of inspection, with penalties in the shape of rejection of the defective work until the defects have been corrected by the workmen.

Another argument against this system and a stronger one than the preceding, is that it fails to take into account the varying price of labor, which is, as a rule, either rising or falling. In a time of business depression, the volume of work is at its minimum and the demand for labor in consequence is not so great as at other times. The price of labor, therefore, falls, but the employer, though needing to make the utmost of the situation in order to continue obtaining his share of such business as is being transacted, cannot avail himself of the opportunity without cutting the piecework prices. He must also reduce the quantities usually manufactured, but in so doing there is taken from the workmen the ability to make normal wages. In either case, dissatisfaction will be the result, with a possible temporary reversion to daywork.

A similar situation will in turn exist when business is above normal. The demand for labor then increases, producing a rise in the price of it, and unless piecework prices are increased to correspond, the workmen once more feel that they are being underpaid.

From the accounting standpoint no system is equal to piecework in the ease with which costs may be figured, though it is becoming more and more the custom, as previously stated, to check every job against a base or standard time, thus taking away from piecework the simplicity which has heretofore appealed to accountants, and putting it more nearly, in

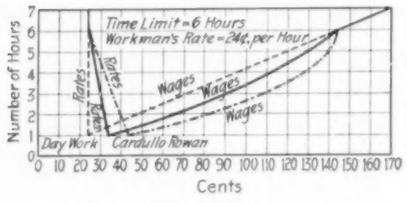


Chart 7. Cardullo Diminishing Premium System

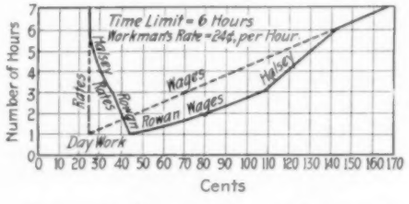


Chart 8. Halsey-Rowan Premium System

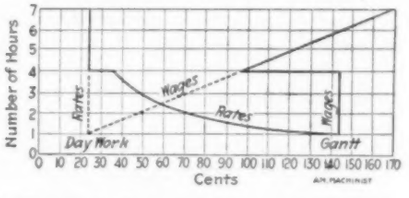


Chart 9. Gantt Bonus or Premium System

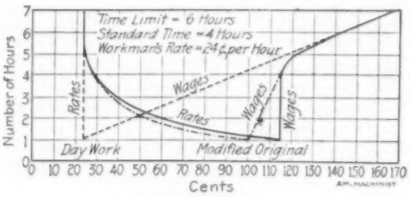


Chart 10. Emerson Efficiency System

this respect, on a basis with premium work.

Manchester Piecework System

The guaranteeing of a day's wage is not the usual custom under piecework systems. However, this is now being done to some extent, the hourly day rate being that paid for the class of labor involved and being fixed at the time of hiring the workmen. The scheme has been designated as the Manchester Piecework System, possibly for the reason that the idea may have first been carried out in Manchester, England. Sometimes the day rates are guaranteed only when the workmen are delayed by causes beyond their control, such as stoppage of the machinery, nonarrival of material, bad crane facilities, hard castings, etc.

Taylor Differential Piecework System

F. W. Taylor has devised a system of piecework in which several graded prices are applied to a single job, a maximum one when done within a certain minimum time, a low price when this time limit is exceeded, and perhaps a minimum price if the work is imperfect, yet passable. There may be even further classifications, as the scheme does not necessarily confine itself to any particular number of prices.

The minimum time in each case is based on the performances of the exceptionally fast and skilled workmen, the idea being to retain only such on the work by making the maximum prices sufficiently attractive to them and at the same time placing the other prices so low that the average workmen will not be satisfied, and will either speedily reach the maximum prices or quit the work of their own accord and seek some other operations for which they are better fitted. As in straight piecework the same formula applies,

$$\left.\begin{matrix}\text{High} \\ \text{low}\end{matrix}\right\} \text{piecework price} \times \text{No. of pieces} = \text{wages}$$

Chart 3 shows the marked variations between the hourly rates when the work is done in the minimum time, and also when such time limit is exceeded.

In general, the same arguments for and against straight piecework apply to this system, with the additional fact that the multiplicity of prices adds to the difficulties of accounting.

The Taylor system originally stood quite alone in requiring that a scientific analysis of each elemental operation in connection with a job be made, so that an intelligent piecework price could be set once and for all without the necessity for "cutting" it later. However, this is now being largely done in other systems of wage payment as well, and is no longer a special feature differentiating this system from others.

Group Piecework System

Piecework may be applied at times with very considerable advantage to groups of workmen and in a variety of ways. A number of workmen may be given a piecework job, the price paid being divided among them on the basis of their fixed hourly (day) rates (mentioned under the Manchester Piecework System) and the number of hours worked by each. Or, a job may be given to a group, the charge hand being paid the difference between the piecework price and the wages at day rates of such helpers as he may have. Though it is usual for the helpers to be assigned to him, he is sometimes free to hire the class of labor required and to pay them either on a daywork or a piecework basis, as may seem to him desirable.

For best results it is advisable to keep the number of workmen in a group within a limit, say of twelve, the idea being to create a feeling of partnership among them, the men taking an interest and helping one another over the hard spots or where difficulty or bad luck overtakes any of them.

One of the chief arguments against the grouping of men is that it kills individual initiative, but the facts prove the contrary where the groups are small in numbers, as it has been demonstrated that the men acually earn higher wages when working collectively than when working individually.

Those sufficiently interested to go further into this phase of the subject are referred to an article in the American Machinist, Vol. 35, page 966, under the title of "A Group System of Wage Payment," in which a rather novel system of group working is quite fully discussed.

Premium or Bonus System

The most recent of the fundamental groups of wage systems is premium or bonus work. It is a combination of daywork and piecework, in that it incorporates time and quantity, the leading features of these two systems. The workmen are guaranteed their daywork wages, and, in addition, they are offered an "incentive" in the shape of a bonus or premium for extra effort over and above that required for the average day's work, provided, however, that such effort results in the production either of increased quantity in the given time, or in standard quantity in less than the given time.

Halsey Premium System

The earliest of the many premium systems now before the public is that of F. A. Halsey. It was devised by him in 1890, while superintendent of the Rand Drill Co., Sherbrooke, Canada. In the scheme, as originally outlined, the workmen were offered premiums equal to one-third or one-fourth of their hourly rates, for every hour saved over and above their previous performances. According to Mr. Halsey:

> Making the hourly premium less than the hourly wages is the foundation stone on which rest all the merits of the system, since by it if an hour is saved on a given product, the cost of the work is less and the earnings of the workman are greater than if the hour is not saved, the workman being in effect paid for saving time.

As now generally operated, a time is estimated for the performance of each job after careful study of the conditions, which time is known as the base or standard time. It is usually the time which the average skilled workman should take to do the job when working as he ought regularly to work, not soldiering. Sometimes the exceptionally fast instead of the average workman serves

Hours Worked	Daywork Wages	Daywork Ho'rly Rate	Straight Piece Wages	Straight Piece Hourly Rate	Differential Wages	Differential Hourly Rate	Emerson (Mod.) Wages	Emerson (Mod.) Hourly Wages	Emerson (Orig.) Wages	Emerson (Orig.) Hourly Rate
7	1.68	0.24	1.152	0.164	0.96	0.128	1.68	0.24	1.68	0.24
6	1.44	0.24	1.152	0.192	0.96	0.15	1.44	0.24	1.44	0.24
5	1.20	0.24	1.152	0.230	0.96	0.18	1.239	0.248	1.239	0.248
4	0.96	0.24	1.152	0.288	0.96	0.36	1.152	0.288	1.152	0.288
3½	0.84	0.24	1.152	0.328	1.44	0.411	1.128	0.322	1.152	0.329
3	0.72	0.24	1.152	0.384	1.44	0.48	1.104	0.368	1.152	0.384
2	0.48	0.24	1.152	0.576	1.44	0.72	1.056	0.523	1.152	0.576
1	0.24	0.24	1.152	1.152	1.44	1.44	1.008	1.008	1.152	1.152

Hours Worked	Rowan. Wages	Rowan. Ho'rly Rate	Cardullo (N = 2) Wages	Cardullo (N = 2) Hourly Rate	Gantt, 50 Per Cent. Wages	Gantt, 50 Per Cent. Hourly Rate	Halsey, 40 Per Cent. Wages	Halsey, 40 Per Cent. Hourly Rate	Rowan-Halsey (50 Per Cent.) Wages	Rowan-Halsey (50 Per Cent.) Hourly Rate
7	1.68	0.24	1.68	0.24	1.68	0.24	1.68	0.24	1.68	0.24
6	1.44	0.24	1.44	0.24	1.44	0.24	1.44	0.24	1.44	0.24
5	1.40	0.28	1.30	0.26	1.20	0.24	1.296	0.259	1.32	0.264
4	1.28	0.32	1.12	0.28	1.44	0.36	1.152	0.288	1.20	0.30
3½	1.19	0.34	1.015	0.29	1.44	0.411	1.08	0.308	1.14	0.324
3	1.08	0.36	0.90	0.30	1.44	0.48	1.008	0.336	1.08	0.36
2	0.80	0.40	0.64	0.32	1.44	0.72	0.864	0.432	0.80	0.40
1	0.44	0.44	0.34	0.34	1.44	0.44	0.720	0.72	0.44	0.44

TABLE 1.—COMPARISON OF WAGE SYSTEMS
Time limit = 6 hours; standard time = 4 hours; workman's rate, = 24c per hour; piece prices = $96—$1.152—$1.44

as the model. No matter which is thus taken there is added to the base or standard time an "incentive" (less if the average workman, greater if the exceptional workman has been the model), the sum of these becoming the time limit or allowed time.

If, now, a job is done in less than the time limit, the amount saved is divided between the workman and the employer in any prearranged proportion. Should, however, the job be done either exactly in the limit or in excess of it, the workman receives but his regular daywork wages for the time employed on the job. In the operation of this system it is customary to guarantee that time limits once set will not be altered unless the method of doing the work is changed; the daywork wages are, as just intimated, also guaranteed.

It is, of course, quite evident that although there may be jobs which have the same base or standard times, it does not necessarily follow that they should likewise have the same time limits. For example, one job may be done under favorable conditions, such as good tools and light, a clean room with uniform temperature, etc., while another job may be performed over a hot fire, in dirty quarters and with changing temperatures. In the latter case it is but fair to add a greater "incentive" to the base time than in the first case, thus making the time limit greater.

What the percentage relation should be between the base or standard time and the "incentive," will depend upon the relation existing between the prevailing day rates of the district in which any particular works is located and those of the works in question. If the latter are below the level of the day rates of the district, then the "incentive" should be higher, and conversely.

As to what constitutes a proper premium or bonus has been very fairly expressed by H. L. Gantt, who says:

> It is such a bonus as will make the workman feel that he is fully compensated for the extra exertion he puts forth. Judged from this point of view it is evident that the bonus depends upon the severity of the work. It varies, as a rule, from 20 to 50 per cent. of the day rate. Task (bonus) work does not necessarily mean more severe work, but it does mean more continuous work and work under more favorable conditions, which always produces greater efficiency.

The following formula applies in figuring wages under the Halsey Premium System:

$$[Time\ Taken + N\ (Time\ Limit - Time\ Taken)] \times Hourly\ Rate = Wages$$

where

N = any fraction as ¼, ⅓, ½, etc.

Chart 4 shows two curves of wages and hourly rates, in which the premiums are 25 and 33⅓ per cent., respectively; that is, the workmen receive premiums equal to one-fourth or one-third of the time saved at their day rates. These curves, it will be observed, indicate another way radically different from any form of piecework in which low costs and high wages may readily go together.

The features which commend this system to the workmen most strongly are the guaranteed day wages, and the noncutting of time limits. On the part of the employer, the strongest features are the share in the direct savings and the ability to grade the workmen on jobs without any cutting of time limits.

It will readily be appreciated that in all works there are improvements always going on, including increased transportation and handling facilities, additional cranes with higher speeds, better lighting and the like. These are of such a nature that while assisting the workmen toward increased output, they are not usually sufficient to warrant any change in time limits, especially as most of the improvements are introduced gradually. Under almost all premium systems the employer shares in these direct benefits along with the workmen, which is not the case in piecework.

The ability to grade workmen is similarly a very important feature. There are many instances in which apparatus, long standardized, may be in danger of being supplanted by a competitor's apparatus selling at lower prices. To meet this situation, or even to anticipate it, the costs may ofttimes be reduced by gradually training lower hourly-rated workmen to the work, the higher-priced workmen being placed on the newer and more intricate products, and thus the life of some one or more specialties is continued for a number of years with advantage to all parties concerned.

Still another feature of premium systems, which should commend them to the employer and to the workmen, is the variation in the hourly rates with the rise and fall in the labor market. They are, on the other hand, open to the same criticism as piecework, namely, that there is a tendency for the quality to fall off with increase in output, but which, as previously stated, may be effectively guarded against by a proper system of inspection. A further argument against them is that the greater the output the less the cost per piece to the employer, and, therefore, the workmen receive less and less per piece, whereas the effort required increases with each piece. From the accounting standpoint, premium systems are more complicated both in the matter of figuring costs and workmen's pay than other systems of wage payment.

Weir Premium System

At the works of C. & J. Weir, Glasgow, Scotland, a slight modification of the Halsey system was said to have been first introduced. It consisted in fixing the premium for all jobs at one-half the time saved. It is more properly the Halsey 50 per cent. premium system. Almost the same formula is used as in the Halsey system:

$$[Tibe\ Taken + ½\ (Time\ Limit - Time\ Taken)] \times Hourly\ Rate = Wages$$

This may be more shortly expressed for accounting purposes as,

$$(Time\ taken + time\ limit) \times \frac{hourly\ rate}{2} = wages$$

Chart 5 shows the variations in hourly rates and wages.

MacLane Double-rate Premium System

A two-rate premium system, modeled somewhat after differential piecework, has been suggested by H. F. MacLane, of the Westinghouse Electric & Manufacturing Co. It was fully described in the American Machinist, Vol. 32, Part 2, page 158. Briefly, it may be said to consist in the payment of either of two rates, from time to time, as conditions warrant. All workmen, upon being hired, would be given two day rates, starting on the lower of the two and thus continuing until any month's pay showed an average of base or standard time to have been made on all jobs for such a period, when the higher day rate would be awarded for the following month. If base or standard time was again averaged for this month by the workman, the higher rate would be continued, but, if not, the lower rate would again come into force for the next succeeding month.

The usual arguments for and against premium systems apply in this case, with the additional one of increased complexity in figuring costs as well as the workmen's pay.

Rowan Premium System

James Rowan, of David Rowan & Sons, Glasgow, Scotland, has developed a premium system to overcome an objection sometimes made against the Halsey 50 per cent. system, and almost invariably urged against piecework; namely, that the interests of the employer are not sufficiently conserved against serious errors in the setting of time limits or piecework prices.

Under the Rowan System a time limit is placed on each job and the workmen receive their hourly rates for the time actually engaged on it, plus a premium, which is figured on the actual time in the proportion of the time saved to the time allowed. The formula for the calculation of wages is:

$$\left[Time\ taken + \frac{(time\ limit - time\ taken)}{time\ limit}\ time\ taken\right] \times hourly\ rate = wages$$

Chart 6 illustrates the variations in the hourly rates and wages. The curves of

the Halsey 50 per cent. system are also shown.

A comparison of this system with the Halsey 50 per cent. system will show that the original idea has been accomplished only in part. It will be noted that while the workmen make less under it than under the Halsey system above "time and one-half," the conditions are reversed below this line. As most of the jobs are, however, usually of the latter kind, the net result would seem to be greater average costs than under the Halsey system.

Aside from this feature, the difficulty of understanding and figuring the premium would seem to constitute a serious objection. The system several years ago received the endorsement of the Amalgamated Society of Engineers, one of the largest labor organizations in Great Britain, through its general secretary, G. N. Barnes. Comparing the Halsey and the Rowan systems, Mr. Barnes says of the former:

> These increasing gains with increasing product would still leave temptation in the way of the employer to cut the time limits and, indeed, would seem to justify it, having regard to estimated and actual times of doing a job in extreme cases. Mr. Rowan's system, on the other hand, gives the man an increase of wage equal to the saving effected from the time limit.

There is considerable force in this criticism, although it is not confined to the Halsey system, but applies to all premium systems and to piecework as well; for, while time limits or piecework prices should not be altered after once being set (unless, of course, the method of doing the work is changed), the employer is not prevented from reducing the time limits or piecework prices on new work, even when it is almost identical with other work on which much higher limits and prices have previously been set.

However, it is manifest that no employer can afford to perpetuate obvious errors, so that it is hardly right to expect, in the event of an error in setting a time limit or a piecework price, that the same limit or price should be used again on similar work.

The preceding remarks lend emphasis to the statement made in an earlier paragraph that any wage system, to be successful, must be treated fairly both by employer and employee, each with the feeling that the other is perfectly honest, in his intentions, at least, even if there seems to be occasional evidence to the contrary.

Cardullo Diminishing Premium System

A system has been developed by Forrest E. Cardullo, which is quite similar to the Rowan system, except that an attempt has been made to conserve the interests of the employer still further, as is indicated by the name of the system itself, and which is at the same time rather against its successful use.

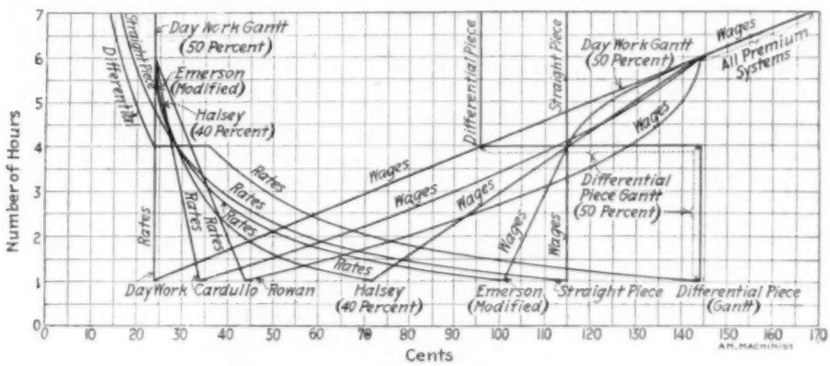


CHART 11. COMPARISON OF WAGE SYSTEMS

Time Limit = Time allowed in which work must be performed in order to earn premium; it is equal to the standard time plus an additional amount called an "incentive." Time limit, six hours.

Standard Time = Time in which work should actually be done by a skilled man working as he ought regularly to work; in some systems this standard time is based on the exceptionally skilled workman; in others it is based on the average skilled workman; in this comparison no difference of this kind is observed. Standard time, four hours.

Workman's rate, 24c. per hour. Piece prices, 96c., $1.152, $1.44.

The formula for figuring wages is almost identical with that of the Rowan system, except that an additional constant is introduced, as shown:

$$\left[Time\ taken + N\,\frac{(time\ limit - time\ taken)}{time\ limit} \times time\ taken\right] \times hourly\ rate = wages$$

Where

N = any fraction

Chart 7 gives the variations of hourly rates and wages and likewise compares them with corresponding curves of the Rowan system. Naturally, the arguments for and against the Rowan system apply to the Cardullo system with added force.

Halsey-Rowan Premium System

In an endeavor to overcome one of the criticisms made against the Halsey and the Rowan systems, Robert Goldmann has suggested that they be combined, the former being used for the lower half of the scale, the latter for the upper half, as shown in Chart 8. In so doing, the danger under the Halsey system of excessive premium, due to wrongly set limits, would be avoided; at the same time the relatively large premiums for small gains under the Rowan system would be eliminated. While it seems that this system would accomplish its purpose, it is not known that it has been tried out practically, and the accounting features are certainly rather complicated.

Gantt Bonus System

H. L. Gantt has devised a system of wage payment, in which each workman who is successful in doing all of his work for a complete turn within the time limits, is given a substantial bonus. In the contrary event, he is paid a day-rate wage for the time employed. The foreman, too, is given a bonus for each workman under him who earns a bonus, and an additional bonus is awarded him if all of the workmen under him earn bonuses.

It is thus doubly to the foreman's interest not to neglect any workman, but to see that all receive a share of his attention, especially in the matter of selecting the right kind of work for each man, in this way tending to stop a criticism heard at some time or another under almost all wage systems that certain favored workmen receive the so called "nice" jobs.

In this system the base or standard time is generally based on the performance of the exceptionally skillful workman, resembling in this respect the Taylor Differential Piecework System. It is open to the same arguments, for and against, as any of the other premium systems. The formula for wages when the work is completed in standard time or less may be expressed thus:

$$Standard\ time \times \left(hourly\ rate + \frac{hourly\ rate}{N}\right) = wages$$

Where

N = any whole number

Chart 9 illustrates the variations in hourly rates and wages.

Emerson Efficiency System

Another bonus system is that due to Harrington Emerson, originally in use on the Atchison, Topeka & Santa Fé Ry., but now installed in various other plants throughout the country, in a somewhat modified form. As first devised, it was the nearest approach to piecework of any of the premium or bonus systems, in that all of the direct profits went to the workmen, the employer gaining but indirectly, that is, only by the reduction of factory expense due to increased production. It was, however, a premium or bonus system, in that time limits instead of piecework prices were set on the

work. The formulas for calculating wages under the two schemes, when the work is completed in base or standard time or less, are as follows:
Original:

$$(Standard\ time \times hourly\ rate) + (standard\ time \times hourly\ rate \times 20\ per\ cent.) = wages$$

Modified:

$$(Standard\ time \times hourly\ rate) + (time\ taken \times hourly\ rate \times 20\ per\ cent.) = wages$$

In either scheme, if the work is completed in excess of the standard time, a premium or bonus is still paid, following a parabolic curve, to which portion the formulas do not apply (though any other curve might have been taken as logically), but gradually diminishing until a point is reached where the time taken exceeds the base or standard time by 50 per cent., when the premium or bonus ceases, after which straight daywork is paid. Chart 10 affords a comparison of the hourly rates and wages under both schemes.

A feature on which considerable stress has very properly been laid by Mr. Emerson in connection with his system, though its application is not confined to it but may be applied to all other wage systems, is the figuring of the productive efficiency of each workman. This consists in adding together the "time taken" by a workman on all jobs over a given period, likewise the corresponding "standard time." Dividing the total "time taken" by the total "standard time" will give the efficiency.

This idea may be carried down to the individual job if desired, or it may be similarly applied to any single department of a works, and the productive labor efficiency ascertained of all the workmen collectively, thus obtaining, in a measure, the efficiency of the foreman. It will, of course, be recognized in this connection, that the productive labor efficiency may exceed 100 per cent., if "standard time" is based upon the performance of the average skilled workman and not upon the exceptionally skilled artisan.

Parkhurst Combination Premium System

This is a system devised by F. A. Parkhurst and is apparently identical with the original Emerson Efficiency System, except that a straight line instead of a parabola is used for the small gains.

Group Premium System

The same general plan may be followed in applying a premium or bonus system to groups as to individuals. Under the group piecework system in the American Machinist, Vol. 35, page 966, will be found a description of a system which has been in successful operation for several years in the East Pittsburg works of the Westinghouse Electric & Manufacturing Company.

Comparison of Wage Systems

A comparison of the various wage systems here discussed is quite difficult, as in some instances the performances of the exceptionally skillful workmen are usually taken in determining base or standard times, while in others the performances of the average skilled workmen are made use of. The difficulty enters in attempting to decide how much these two bases differ.

In comparing these several systems here, however, such differences have been ignored and the base or standard time is assumed to have been arrived at under the same conditions in all cases. In straight piecework the price is considered as being the same as in the premium systems when the piece is completed in the base or standard time. The Halsey 40 per cent. system is used in order to correspond with the 20 per cent. incentive of the Emerson efficiency system. In the Cardullo system, N is taken as 2, simply to distinguish it from the Rowan system. The bonus in the Gantt system is arbitrarily taken at 50 per cent. of the day rate for making standard time or better, plus one-half the time saved at the day rate. Table 1 and Chart II compare the several systems numerically and graphically.

Gain or Profit-sharing Schemes

Gain or profit-sharing schemes are becoming more and more numerous and are varied in the extreme. They are, perhaps, applied more frequently to the office or nonproductive force of an establishment than to the productive element.

A number of years ago, Henry R. Towne, of the Yale & Towne Manufacturing Co., Stamford, Conn., developed and used successfully a very novel gain-sharing scheme. As set forth by him:

> The system . . . aims to afford a basis for allotting to the employees in a business a share in the gain or benefit accruing from their own efforts, without involving in the account the general profits or losses of the business.

Applied by him, an average cost per unit was first determined upon, after which any saving effected in the cost of the total output in a given period, resulting from the efforts of the workmen themselves, was proportioned on the basis of 50 per cent. to the company, 40 per cent. to the workmen and 10 per cent. to the foremen. Each workman was guaranteed his regular wages, so that it is at once seen the workmen shared the profits, but were protected against possible losses. The workmen's share of the profits was divided among them on the basis of wages earned. It is understood that this scheme is no longer in effect.

One of the most original and liberal schemes of profit-sharing is that in force at the Nelson Valve Co., St. Louis, Mo. This concern divides profits in excess of 6 per cent. among employees and customers, the former participating on the basis of salaries or wages, the latter on the gross profits resulting from their purchases.

The Crane Co., Chicago, Ill., has tried a number of profit-sharing schemes, and about nine years ago fixed upon its present one, which simply consists in giving annually to all employees, excepting officials, an amount ranging from 5 to 10 per cent. of their salaries or wages, depending upon the profits of the business for the last fiscal year. There is no requirement in regard to length of service.

The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, operates under a premium system and has in force a scheme of monthly profit-sharing among the nonproductive portion of its employees, including tool, pattern, drawing and cost departments. It resembles somewhat the one used by the Yale & Towne Manufacturing Co., except in the percentage distribution of profits, 50 per cent. of the time saved going to the workmen, 25 per cent. to the foremen and the remaining 25 per cent. to the so called nonproducers in these nonproductive or expense sections.

In the productive sections each foreman is credited with a bonus of 5c. per hour for every hour saved from the time limit, or allowed time, on all jobs done by the workmen under him, and debited with 20c. per hour for every hour any job is overrun, the difference between these two accounts constituting the bonus.

Among other firms that may be mentioned as having gone in for profit-sharing in some form or another are: Le-Claire & Co., Paris, France; Lever Bros., Port Sunlight, England; South Metropolitan Gas Works, London, England; Union Switch & Signal Co., Swissvale, Penn.; U. S. Steel Corporation, Pittsburg, Penn.; Brooklyn Edison Illuminating Co., Brooklyn, N. Y.; International Harvester Co., Chicago, Ill.; Proctor & Gamble, Cincinnati, Ohio.

The leading criticism made against this method of rewarding employees is that the allotment of the profits once a year is too infrequent, though this does not hold in all cases, as, for instance, at the Lodge & Shipley Machine Tool Co., where the allotment is on a monthly basis. An additional criticism is that the employees do not share in the losses. The principal argument in favor of gain or profit sharing is that it increases the *esprit de corps*, a most desirable achievement, and one whose value it is impossible to measure in mere dollars and cents.

An Old Punch Press

While going through the shop of the Cardwell Machine Co., Richmond, Va., the manager, George W. Hunter, showed a curious old punch press or shear, hidden away in a storeroom.

The body of the press, as shown in Fig. 1, is held on a pair of skids by four wooden braces or legs. The ram is screw-operated, an automatic single-belt attachment for reversing the screw being one of the principal features of the machine.

To the upper end of the screw, a large gear *A* is keyed. This gear is in mesh with a long pinion on the lower end of the same vertical shaft that carries the large bevel gear *B*. Into this large bevel gear, two bevel pinions *C* and *D* are meshed. The pinion *C* is on the same shaft *E* with the pulley *F*, and *D* is on a sleeve with the pulley *G*, through which the shaft *E* runs. Pulley *H* is an idler.

A single belt runs in through the guide *I*, and this guide is fastened to the shifter *J* operated by the lever *K* on the shaft *L*. Two adjustable fingers *M* and *N*, operated by the cams *O* and *P* on the gear *A*, work the belt-shifting mechanism at the proper time to give the ram its stroke up or down. A lever is placed at *R* so that the belt may be shifted by hand when desired. At *S* is a small iron pulley, carried on the long flat spring *T*, which fits into semicircular notches in a piece *U*, riveted to the shifter rod *J*.

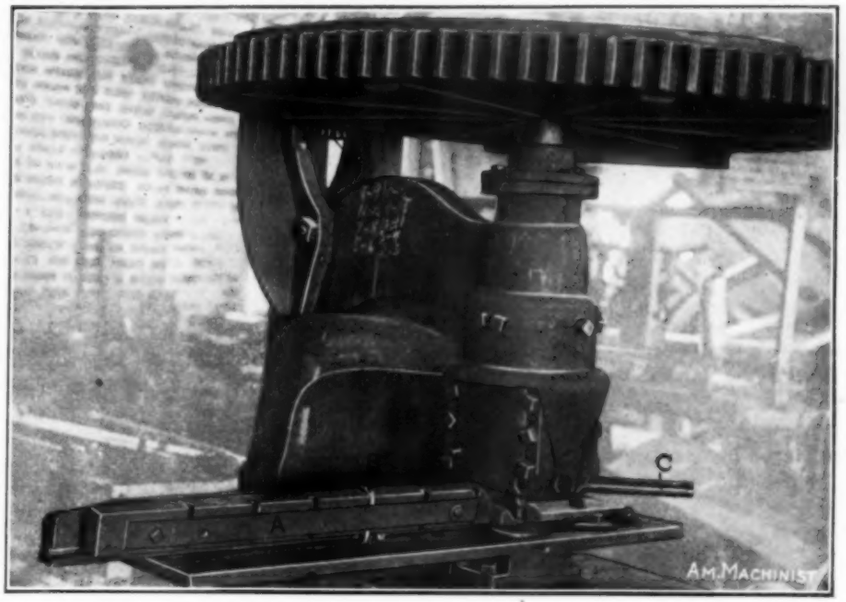


FIG. 2. STOCK-SPACING DEVICE

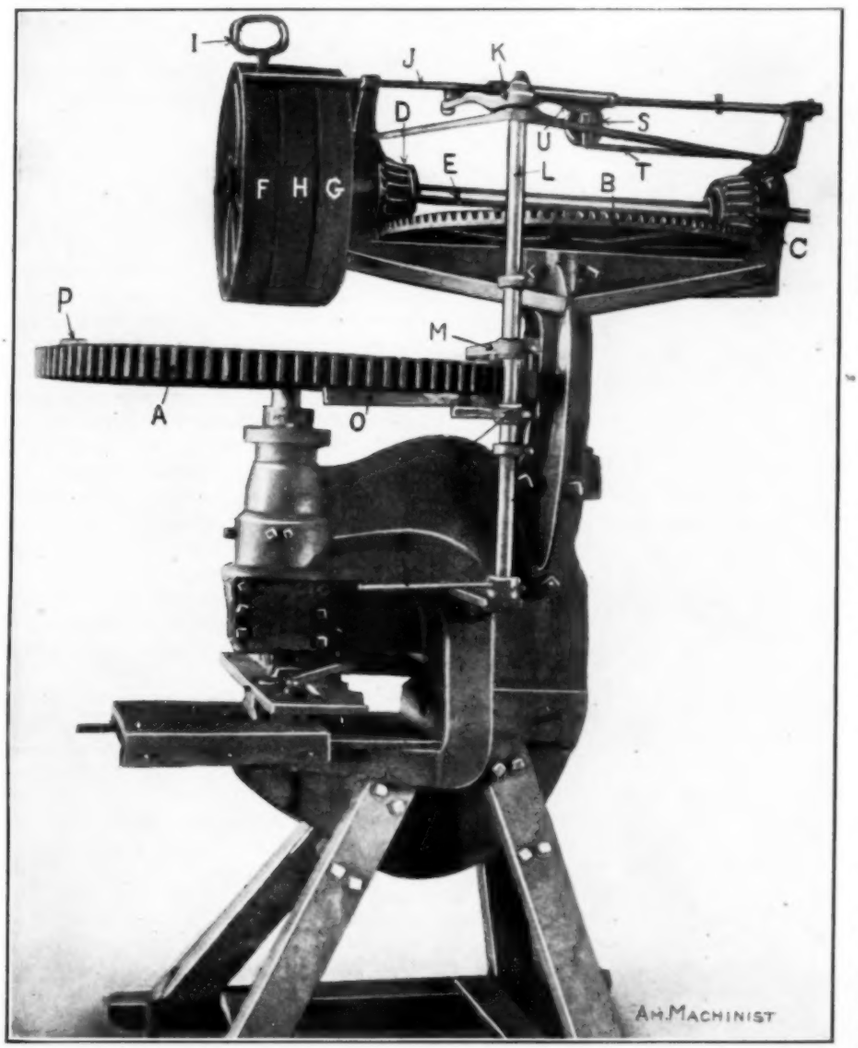


FIG. 1. AN OLD BELT-OPERATED SCREW PRESS

There are three notches in the piece *U*, one for each pulley, and as the shifter is moved so that the belt will run on any one of the pulleys, the iron pulley *S* fits into a corresponding notch and locks the shifter in position, there being sufficient tension on the spring for this, yet not enough to prevent the shifter being easily moved by the proper levers.

The press was apparently last used for shearing off heavy strap iron, or possibly notching angle iron. The spacing device used is shown at *A*, Fig. 2, a space pin being in one of the slots at *B*. A lever used to operate a clamping device to hold the stock solid under the punch is shown at *C*. A part of the pinion operating the big gear is shown at *D*.

No name appears on the machine but from what could be learned it was built some time in the '50's by H. M. Smith, a former owner of the shop.

Experiments have recently been conducted on the proper temperatures for annealing brass in order to attain the best combination of strength and ductility. According to the *Metal Industry* this temperature has been determined to be between 600 and 700 deg. C. It has been shown that the atmosphere of the annealing furnace, whether oxidizing or reducing, does not appear to affect in any well marked manner the properties of the brass.

Screw Jacks for Lifting

By Walter Heap

A suggested design of screw jack embodying several advantages, and the order of manufacturing operations for economical production.

An engineer would not cut a helical groove or thread into a column for supporting a floor, or part of an engine, because he knows it would not be as strong as a plain column, the diameter of which is equal to the diameter at the bottom of the thread. He will, nevertheless, make the "column" in a screw jack, which supports the load being lifted, with a helical groove or thread throughout its entire length.

A screw jack is only a temporary support for the lifted load, but the efficiency of such support requires adequate consideration. Being "only a screw jack" it is usually regarded as not worth scientific consideration. The naked screw in the ordinary screw jack will not bear the criticism of a thoughtful engineer; it is really bad practice, and when all is said in its favor its general construction is such as will not add to the reputation of the designer as an engineer—it is a makeshift job.

The screw has to be made abnormally large to bear the eccentric loads put upon it. The thread gets "burred" and if the burr is forced into the nut, the thread in the nut will also be damaged. This burr generally happens to be entering the nut at a critical moment, and the extra power required to turn the damaged screw, would in some instances, cause the whole job to topple over. The screw jack with a naked screw is a very second-rate appliance, when compared with the one here described and designed to meet the contingencies and rough usage which a screw jack encounters.

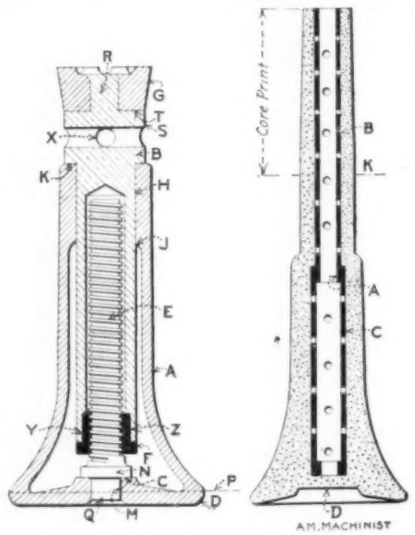
When designing an article of this description, strengths should be carefully calculated, and after allowing an ample factor of safety, the result of such calculations should be doubled. The screw jack is then foolproof.

The Construction

A sectional elevation of a screw jack capable of lifting a load of 4000 lb. with a large factor of safety is shown in Fig. 1. The body *A* is of cast iron. The upper portion only serves as a guide for the spindle *B*, the load being received in the center of the base at *C*. The base is made thicker than any other portion of the casting. The edge of the base is rounded at *D* to prevent injury should it fall, and to facilitate moving sideways when positioning for lifting.

The screw *E* is of 1¼-in. diameter, 4 threads per inch, left hand, and is riveted in the base; *F* is the nut 1½ in. deep, being a press fit in the spindle *B*. The crown *G* is made of cast iron, and riveted loosely on the pivot *R*. The head *S* of the spindle has two ¾-in. holes drilled through for the tommy bar used for turning the spindle when lifting; the head being knurled, it can be screwed up and down by hand when there is no load on.

The jack as shown in the illustration has a lift of 7½ in. and will then measure 15½ in. high. The base of the nut *F* will then be level with the bottom of the hole *H* at *J*. A jack to lift 12 in. will measure only 20 in. high.



Screw Jacks

Advantages of this Type

The conspicuously good points follow: The screw *E* is small in diameter and has a comparatively fine thread; consequently less power or force is required to raise a given load than with the coarse-pitch screw of the ordinary jack. The whole of the screw is protected *all* the time from knocks and dirt, and can always be kept well oiled. The only stress upon the screw is that of compression; it has no bending stress to meet.

The spindle *B* is a plain, hollow column, the very best form for meeting eccentric loads and rough usage. Should it get knocked badly enough to prevent it going down into the hole *H*, a few strokes with a flat file will remove the lump raised by the knock.

It has five good points: Reduced exertion when lifting owing to the fine threaded screw; perfect protection of the screw from injury; perfect lubrication of the screw and freedom from dirt and grinding; no bending stress upon the screw; a plain hollow cylindrical column to meet eccentric or uneven loading.

A screw jack manufactured on these lines is really a high-class tool designed to meet rough usage, but it can be produced cheaply. A suggested order of manufacturing operations follows:

Pattern Shop

Body A. The form of the body *A* is such that it will be molded in a deep-bottom flask, and the shallow top one, cast with the base upward and "parted" in the flasks at *P*, Fig. 1, the base being in the top flask. A wooden model or pattern will be made allowing two contractions and one turning outside, and two at *K*, so that a light hollow-iron pattern may be made.

The iron pattern must have a core print 6 in. long cast upon it at *K* to hold the core, Fig. 2, in a perfectly upright position, so that the axes of the core and mold will coincide.

Crown G. The pattern for this will be made for an iron pattern which will machine all over, and an allowance made for the facing at *T*, Fig. 1. The crown to be cast without the hole.

Foundry

Body A. The core, Fig. 2, is formed with an iron strickle upon a core barrel made out of two pieces of tubing welded together at *A*, having vent holes drilled in to allow for the escape of gases. The tube *B* is 1 in. in diameter outside and *C* is 1⅜ in. in diameter. The sand at *D* is put in after the core is turned. The cores are put upon the spindle (in the tube *B*) projecting from each side of a cast-iron stand in the drying stove.

The gate, or runner, should be at the bottom of the mold so that the risk of washing will be avoided, and so as to leave the base perfectly flat to go against the lathe chuck when being bored. The head of the runner should be well above the base of the body to insure a sound casting. The molding flasks should be made of iron and their joint faces planed. The pins holding the flasks together should fit well.

Crown G. This can be made upon the plate on a molding machine, cast with the face *T* down to insure a good surface when machined.

Machine Shop

Body A. The body is bored in a chucking lathe having a turret tool box, and held in a three-jawed chuck, the jaws being special to grip the body at *L*. These force the base firmly against the face of the chuck and hold it central as well.

There are six operations: First, the hole *H* is bored with a cylindrical drill; the face *K* is then turned with a face mill; next the hole *H* is reamed to the finished diameter; after this the hole *M* is drilled with a drill fixed in the bar which fits the hole *H;* now the face *C* is faced with a face mill and the hole *M* is countersunk in a driller.

On the screw E there are five operations: The stock, of black machine steel 1¾ in. in diameter, is first cut off in the parting-off lathe, then centered, after which the screwed portion is turned to the 1¼-in. diameter with a round-nose tool to leave a fillet at the collar *N*, which is left black; next the pivot *Q* is turned with a side tool to leave a square shoulder under the collar *N;* the screwed portion is then chased left hand to the internal screw gage, four threads per inch.

On the spindle *B* there are seven operations: It is first turned and bored in the hollow spindle lathe with the turret tool box. The stock is bright machine steel 2¾ in. in diameter. The first operation is to bore a 1 $\frac{5}{8}$-in. hole with a twist drill, next to counterbore at *Y* for the nut, then turn the outside to the 2⅛-in diameter; the pivot *R* is then turned, the head *S* knurled; next comes the parting off and finally the tommy holes *X* are drilled in a jig.

The nut *F* is made in the same lathe as the spindle. The stock is bright machine steel 2⅛ in. in diameter. There are four operations as follows: Drilling the 1-in. hole; tapping with the 1¼-in. left-hand, square-thread tap; turning *Z* which, must be a press fit in the spindle *B*, and parting off.

Crown G is machined in the small chucking lathe in three operations, the first of which consists of drilling the 1-in. hole with the twist drill, next facing the base *T*, and last countersinking the top side smoothly in the drilling machine.

The assembling operations are as follows: Riveting the screw tight in the base of the body, and leveling the rivet head; forcing the nut *F* into the bottom end of the spindle *B*, and riveting the crown *G* on the spindle loosely, so that it is free to revolve; screwing the spindle into the body, and painting.

All working parts must be well oiled. The time required to perform these operations should not exceed six hours at the most, when manufacturing in quantities.

Strength of Rolled Zinc

Bulletin No. 52, of the Engineering Experiment Station of the University of Illinois, written by Herbert F. Moore, deals with an investigation of the strength of rolled zinc.

The summary of results includes the six following items:

Zinc either rolled or cast has no well defined yield point and its elastic limit is very low. Zinc possesses a relatively high degree of plasticity.

The ultimate tensile strength of thin rolled-zinc plate (not more than 0.5 in.

Thickness of rolled plate in.	Number of specimens	Ultimate stress, lb. per sq. in.	Modulus of elasticity lb. per sq. in.	Elongation in 8 in. per cent	Reduction of area per cent	Speed of pulling in .per min.	Directions in which specimen was tested
Cast	6	9,060	11,025,000	slight	slight	hand	———
1	5	22,200	———	7.56	8.72	0.3	With grain
1	4	21,340	10,450,000	4.85	6.58	0.5	With grain
1	3	23,050	10,370,000	0.31	5.37	0.5	Across grain
0.6	12	21,490	11,033,000	16.63	22.25	0.5	With grain
0.6	5	23,550	10,780,000	3.33	5.80	0.5	Across grain
0.25	12	23,770	12,767,000	11.90	19.17	0.5	With grain
0.25	6	22,260	10,967,000	0.27	5.07	0.5	Across grain
0.10	6	22,280	10,650,000	18.75	———	0.5	With grain
0.10	6	24,870	———	21.00	———	3.25	With grain
0.10	6	33,620	13,700,000	14.3	———	0.5	Across grain
0.018	6	25,490	10,533,000	———	———	0.5	With grain
0.018	2	29,810	———	———	———	1.37	Across grain
0.018	3	23,840	———	———	———	0.2	With grain
0.018	6	34,960	———	———	———	0.5	Across grain
0.006	6	24,110	———	———	———	0.2	With grain
0.006	6	26,480	14,800,000	6.5	———	0.5	With grain
0.006	3	33,830	———	———	———	0.5	Across grain
0.006	3	38,440	———	———	———	2.5	Across grain
0.018	3	24,200	———	———	———	0.5	With grain
0.018	2	35,150	———	———	———	0.5	Across grain

The values given are the average results for the number of specimens noted in the second column.

TABLE 1.—TENSION TESTS OF ZINC.

Nominal thickness of plate in.	Number of specimens tested	Diameter of punch in.	Speed of punching in. per min.	Ultimate shearing stress developed lb. per sq. in.	Energy required to punch in lb. per sq. in. per in. thickness
1.00	9	0.75	0.10	18,750	7,260
1.00	9	1.00	0.10	19,060	6,650
0.60	6	0.50	0.10	19,740	10,590
0.60	6	0.75	0.10	19,350	8,630
0.60	6	1.00	0.10	18,990	6,400
0.25	6	0.50	0.10	20,000	10,550
0.25	6	0.75	0.10	19,700	8,740
0.25	6	1.00	0.10	19,390	8,030
0.25	6	1.00	0.50	19,400	8,350
0.25	6	1.00	1.60	20,850	8,380
0.10	6	1.00	0.10	18,230	5,650
				Av. 19,400	8,110
0.018*	9	1.00	0.10	12,930	———
0.018*	6	1.00	0.10	13,380	———
0.018*	9	1.00	0.10	10,880	———

*In the very thin plates, shearing took place unevenly around the circumference of the punching tool. The values given are the average results for the number of specimens noted in the second column.

TABLE 2.—PUNCHING TESTS OF ZINC.

Nominal Thickness of plate in.	Number of specimens tested	Speed of shearing tool in. per min.	Ultimate shearing stress developed lb. per sq. in.	Energy required to shear in. lb. per sq. in. per in. thickness	Direction in which specimens were tested
1.00	6	0.10	16,700	4,850	Across grain
1.00	3	0.10	16,580	4,510	With grain
1.00	6	0.50	17,140	4,130	Across grain
1.00	6	1.60	17,770	4,330	Across grain
0.60	6	0.10	16,580	5,100	Across grain
0.60	3	0.10	17,380	4,620	With grain
0.60	6	0.50	15,480	4,640	Across grain
0.60	6	1.60	18,100	4,410	Across grain
0.25	6	0.10	18,860	6,690	Across grain
0.25	3	0.10	18,170	4,620	With grain
0.25	6	0.50	15,480	4,640	Across grain
0.25	6	1.60	17,040	5,730	Across grain
			Av. 17,100	4,850	

The values given are the average results for the number of specimens noted in the second column.

TABLE 3.—SHEARING TESTS OF ZINC.

Nominal thickness of plate in.	Number of specimens tested	Dinmeter of punch in.	Speed of punching in. per min.	Ultimate shearing stress developed lb. per sq. in.	Energy required to punch in. lb. per sq. in. per in. thickness
0.375	2	0.75	0.10	50,000	30,350
0.375	2	1.00	0.10	50,080	19,880
				Av. 50,040	25,200

For purposes of comparison with punching tests of zinc plates.
The values given are the average results for the number of specimens noted in the second column.

TABLE 4.—PUNCHING TESTS OF STEEL PLATE.

thick) is about 24,000 lb. per square inch.

The modulus of elasticity of zinc in tension is about 11,500,000 lb. per square inch.

The stress per square inch of area sheared developed in punching or shearing rolled-zinc plates is about 40 per cent. of the stress developed in punching or shearing mild-steel plates.

The energy per square inch of area sheared per inch thickness of plate required to punch or shear rolled-zinc plates is about 30 per cent. of the energy required to punch or shear mild-steel plates.

The ductility of rolled-zinc plates is much less than that of mild steel, and the ductility of zinc plate with the grain is greater than the ductility across the grain.

Of the accompanying tables, Table 1 gives average values for a number of tension tests, Table 2 for punching tests and Table 3 for shearing tests. Tables 4 and 5 are from punching and shearing tests of steel, respectively, and are included for comparison.

The final tables give the shearing and compressive strength of cast zinc. From Table 6 the fiber stress in torsion at the limit of proportionality of stress to angle of twist is seen to be 5450 lb. per sq.in. From Table 7, the fiber stress at the limit of proportionality of stress to compression is seen to be 1620 lb. per square inch.

Nominal thickness of plate in.	Number of specimens tested	Speed of shearing tool in. per min.	Ultimate shearing stress developed lb. per sq. in.	Energy required to shear in. lb. per sq. in. per in. thickness	Shearing with grain or across grain
1.000	2	0.10	44,700	11,580	Across grain
0.625	2	0.10	37,200	17,750	Across grain
0.375	3	0.10	46,970	18,850	Across grain
0.375	3	0.50	43,000	16,740	Across grain
0.375	2	1.60	44,500	19,630	Across grain
			Av. 43,270	16,910	

For purposes of comparison with shearing tests of zinc plates.
The values given are the average results for the number of specimens noted in the second column.

TABLE 5.—SHEARING TESTS OF STEEL PLATE.

Number of specimens tested	6
Maximum fiber stress at limit of proportionality of stress to angle of twist	5,450 lb. per sq. in.
Computed maximum fiber stress at rupture	15,260 lb. per sq. in.
Modulus of elasticity in shear (Torsion)	4,570,000 lb. per sq. in.

TABLE 6.—TORSION TESTS OF CAST ZINC.

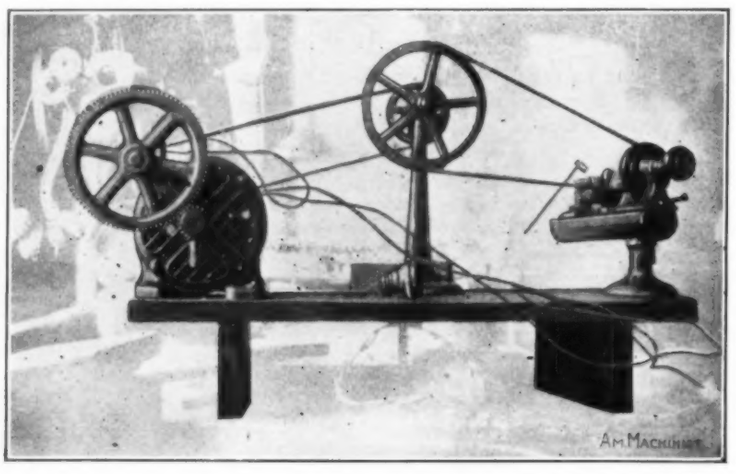
Number of specimens tested	4
Fiber stress at limit of proportionality of stress to compression	1,620 lb. per sq. in.
Modulus of elasticity	6,900,000 lb. per sq. in.

TABLE 7.—COMPRESSION TESTS OF CAST ZINC.

Portable Lathe Outfit

The shop of M. J. Boyce, 584 Hudson St., New York, handles a large amount of experimental work, some of which requires the use of watch-maker's or precision lathes. In order to have this convenient at any desired point in the shop, the whole outfit is mounted on a portable platform, as can be seen in the illustration. It can, therefore, be carried to any part of the shop, and connected to any lamp socket for its supply of current.

A small one-sixth horsepower motor is mounted at the back end of the platform, and on this is suitable reduction gearing as shown, which in turn drives the small jackshaft in the center, power being transmitted from this to the lathe itself.

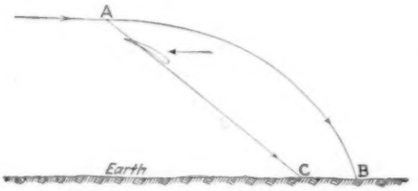


PORTABLE LATHE OUTFIT

For Safety in Aeronautics

M. Louis Bleriot, in a recent communication to the French government, has explained a large number of recent aëroplane accidents.

It had been noticed, though generally discredited as "impossible," that in several instances where a machine has collapsed during a volplane, the wings were bent downward. Bleriot has verified and explained this kind of accident.



FOR SAFETY IN AERONAUTICS

During a steep volplane, the pressure shifts from the underside of the plane to the upper, causing the light upper trusses to break. The accompanying diagram shows that this is obviously the case. Suppose the machine to be traveling in a horizontal plane. If at *A* the motor is shut off but the controls not changed, the machine would continue along the trajectory curve to *B*. But, as is the case in the usual volplane, the elevator is depressed, causing the machine to take the course *AC*. To effect this change of direction, a pressure must be applied to the upper surface of the wing, thus in an instant reversing the pressure on the plane.

The machines of the French aërial fleet are now being trussed from above as well as below, the safety factor of these wires being made three-fifths that of the down trusses.

This change, which comes as the direct result of four fatal accidents, will greatly modify aëroplane construction, and tend toward greater safety, particularly in monoplanes.

The quantity of cement produced in the United States, according to figures of the Bureau of Statistics presented in its Statistical Abstract, recently issued, has grown from 8 million barrels in 1890 to 17 million in 1900 and 78 million in 1910, the value having increased from 6 million dollars in 1890 to 13 million in 1900 and 69 million in 1910.

Grinding Inserted-Tooth Cutters

By W. S. Tyler

A grinding device where the object is to so grind the cutters that when they are put into the cutter head they will all cut evenly.

In using face milling cutters the operator necessarily spends considerable time grinding the cutters so that they will all cut evenly. A cutter is most efficient and durable when it has a well rounded corner. It is not a difficult matter to make a holder for grinding such cutters, slotted so as to give the proper face and circular clearance, but they would have sharp corners. To grind these round corners of the required uniformity and with reference to the other cutting surfaces is when the difficulty arises.

The object of this device is to grind the circular and face clearance and the round corner at one operation from the working surface of the cutter. Right- and left-hand face milling cutters of the inserted-tooth type, as indicated in Fig. 1 were used. The service was severe and constant. To keep these cutters ground and in order without undue interference with the progress of the work was a serious problem. The form of cutter which gave the best service is shown in Fig. 2.

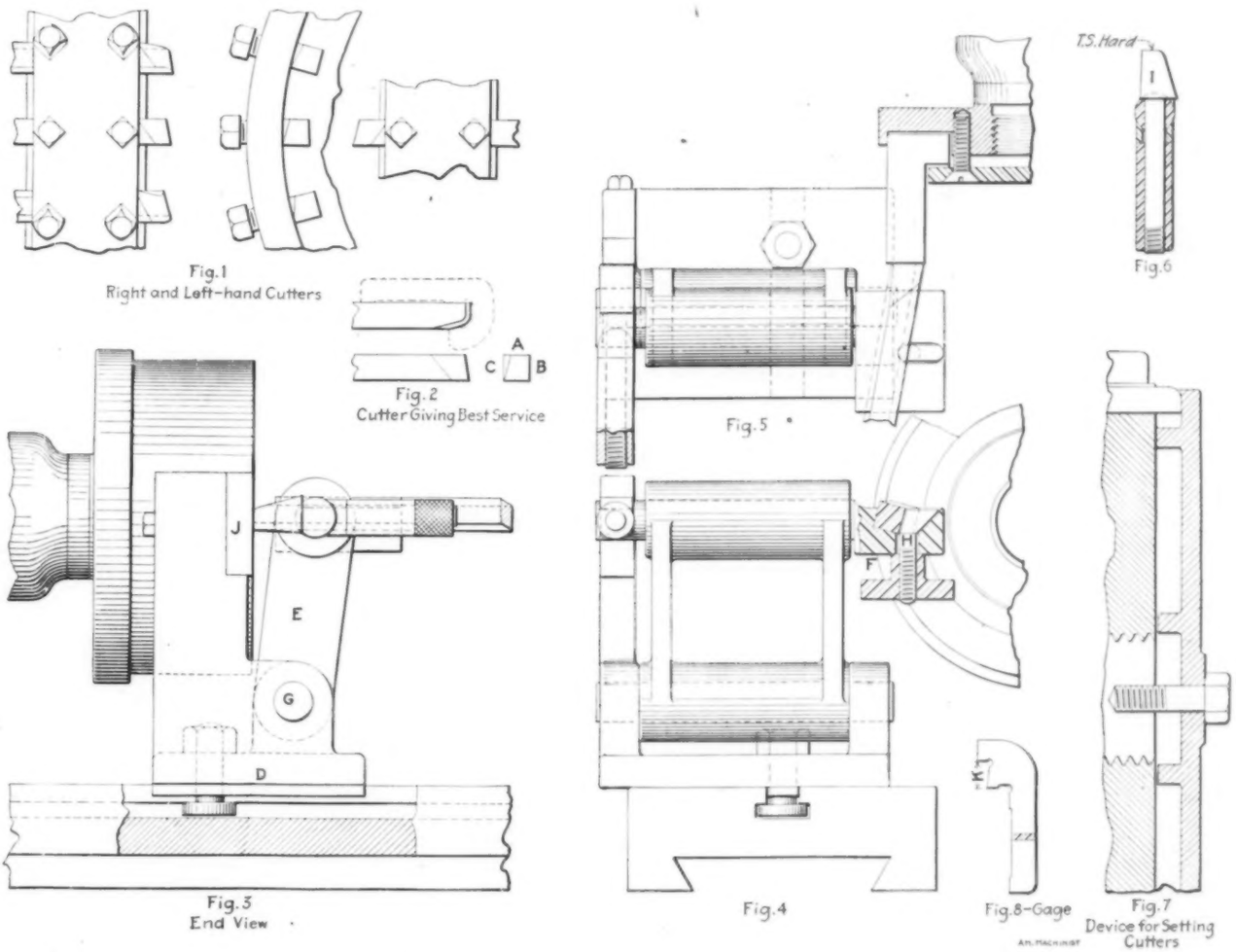
Grinding Quantities Uniformly

No means of grinding the cutter with the required measure of uniformity were available. It was desired to grind cutters in quantities, so that when a set was dulled it could be readily removed and the sharp set substituted. The device illustrated does the work in a very satisfactory manner. At the outset particular pains was taken to have the cutter slots in the body milled true. For the cutters ½-in. square high-speed steel was used. Three sides of the cutter, *A*, *B* and *C*, Fig. 2, were good. These are the bearing surfaces and a nicer measure of accuracy in the grinding is secured with these surfaces finished.

The cutter slots were milled ½ in. wide and the cutters were ground to a gage somewhat less. They fill the slots fairly well sidewise, but the other way there is about $\frac{1}{16}$ in. play.

The grinder employed in this instance was a small one of the universal type. A cup wheel 6 in. in outside diameter and 4½ in. inside, was mounted on it; giving a grinding face ¾ in. wide.

The grinding device is shown in Figs. 3, 4 and 5. Fig. 3 represents the end view, Fig. 4 the side and Fig. 5 the top view. The device consists of the body *D* which is bolted to the sliding table of the grinder. The swinging bracket *E*, Fig. 3, carries the cutter-holder. It is attached to the body *D* by means of the pin *G*. The cutter-holder *F*, Fig. 4,



Grinding Device for Inserted-tooth Milling Cutters

is provided with a stem which turns easily in the bracket *E*.

Details of the Cutter Holder

One end of this cutter-holder is flattened and adapted to take the cutter. It has a slot milled at such an angle with the axial and a vertical line as to give at once the proper face and circular clearance. It is provided with a clamp *H* which holds the cutter against the ground surfaces *A* and *B*, Fig. 2.

The sectional view Fig. 4 and the top view Fig. 5 show the cutter in position to be ground. The end of the stem extends through the bracket *E* and is adapted to take the form *I* shown in section in Fig. 6. This form *I* is made to be readily taken out and put back for the purpose of changing from a left-hand to a right-hand holder, or when the face of the wheel is to be dressed. The form *I* gives the cutter its shape.

A hardened-steel stop piece attached to the body *D* is shown at *J* in Fig. 3. In grinding, this stop piece should be placed in line with the face of the wheel. To do this a cutter previously ground is set in the holder to a gage, Fig. 8, made especially for this purpose, the form *I* is pressed up to the stop *J*, the cutter is brought up to just touch the wheel, then the slide is tightened so that it will not move.

Grinding the Cutters

To grind, the cutter is placed in the holder to a gage like that shown in Fig. 8 except that it is a little longer at *K* to allow for the metal to be ground away to make the cutter sharp. When this is done, the cutter is pressed up to the wheel, moving it over the surface to be ground until the form comes up to the stop. When all the metal which the form will permit is removed the cutter is finished.

The form must be pressed up firmly against the stop *J* so that the entire surface of the cutter is ground to the exact shape given it by the form. When the cutter is being ground to shape, as determined by the form, it should at the same time be given the lateral movement for which allowance has been made, so as not to wear the face of the wheel unevenly.

When a large number of cutters are to be ground, it is well to rough grind them, then carefully reset the machine and go over them lightly. New cutters are usually rough ground to an approximate shape on the regular grindstone.

A device is used to hold a diamond. This is inserted in the bracket in place of the holder for the purpose of dressing the wheel parallel with the hole in the bracket. It slides in the bracket a distance a little more than the face of the wheel.

A gage is shown in Fig. 2 by dotted lines around the cutter; it is well to try this gage frequently, as it gives the size from the bearing surface of the cutter to the cutting surfaces. A number of these cutters can be ground befor the table needs readjusting. A moderately hard wheel is best suited to this work. The wheel must be set with reference to the point of the cutter, so that when the cutter is carried down to the lowest and up to the highest point, nearly the entire face of the wheel has been used.

Grinding Tools for the Turret Lathe

In designing turret lathe tools it is frequently desirable to set the cutter in the holder at an angle with the axial line of the spindle. These cutters are sometimes required to turn and face and it is desirable that the cutting surfaces shall be in a given relation to the bearing surface of the cutter as it is clamped into the holder. To grind these cutters correctly from the seat requires considerable skill and time. By making a suitable holder and form such cutters may be ground advantageously with this device. They can be ground in considerable numbers and given to the operators so that when a tool becomes dulled it can readily be replaced and the operator relieved of grinding.

On millers of two different makes the cutters screwed onto the spindles. One make of machine had a coarse-pitched thread and the cutters were easily removed, but the other had a fine pitch and the cutter heads were removed with difficulty.

Device for Substituting Cutters

In this case, when the dulled cutters were to be removed and sharp ones substituted, the device shown in section in Fig. 7 was used. This is a gage plate screwed up to the face of the cutter body by means of a bolt screwed into the end of the spindle. This circular plate has two annular ribs on its face, one with its inner diameter about the size of the spindle nose, the other having its outer diameter a little less than the cutter circle. These ribs set the gaging surface of the plate the required distance from the face of the head. This method of setting the cutters is used in all cases.

After the dull cutters have been removed this gage plate is fastened to the head and the cutters are pushed up to the surface, as shown, and the setscrews for holding them tightened, then the plate is removed and the cutters are again ready for service. This is done without removing the cutter head from the spindle.

Extra Cutter Bodies

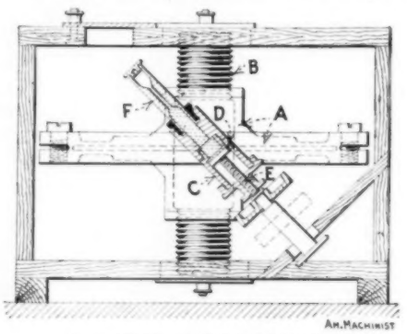
With the other machine there were extra cutter bodies and when the cutters became dulled it was a simple matter to remove the cutter head from the spindle and put on another, holding sharp cutters. The head having the dulled cutters was screwed on a stud. This stud has a shank which fits into a bracket fastened to the bench. The threaded end of the stud has a hole tapped in it for a bolt to hold the gage plate as in Fig. 7. The dulled cutters are removed, the gage plate screwed on and the newly ground cutters inserted as described.

While this device is made for one particular type of grinder, the principles are such that it can be easily adapted to almost any type of machine. With it only an ordinary degree of skill is required to do the work correctly. The holder shown is for left-hand cutters; for right-hand cutters the slot is made in the opposite way and the clamp put on the opposite side.

A German Extensometer

The extensometer here illustrated depends for its action upon the enlarging or diminishing under tension or compression of a flat reservior between two disks, containing mercury. The excess of mercury is measured in a small cylinder by means of a micrometer screw. The instrument is made for both tension and compression tests or for tension alone, the latter form is the one illustrated.

The metal disks *A* are bolted together at their rims, the small hollow between being filled with mercury. Tension is applied through the short bars *B*, which are mounted with screw couplings. As tension is applied, the disks are pulled apart



A German Extensometer

and more mercury flows in from the tube outside. The disks are grooved near their outer edges to bring flexure at a predetermined place.

The change in volume is measured in the cylinder *C*. A micrometer screw, carrying the piston *D*, is used to bring the level of the mercury to a line in the hair tube *F*. The relation between volumes and loads is determined by calibration. The form of instrument for both tension and compression differs from the above in that each disk and its bar are in a single piece.

The instrument may be used either in a horizontal or vertical position. The tension form is regularly made in 30- and 50-ton sizes. The regular size for the combined tension and compression form has a capacity of 20 tons.

This extensometer is built by George Wazau, Gerthain, Sa. Germany.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Finished in the Foundry

Having worked for a company whose product consisted principally of die castings, and having acquired an elementary knowledge of that process and its possibilities, I have often wondered if some process could not be developed that could use the harder and more common metals

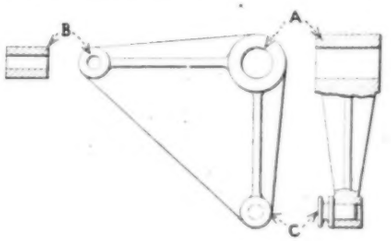


FIG. 1. PART TO BE MANUFACTURED

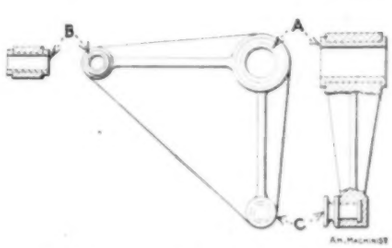


FIG. 2. CAST TO ELIMINATE MACHINING

such as iron, brass and aluminum, and would produce finished or partially finished work.

I shall not dwell upon the advantages of die-cast parts, as that subject has already been ably treated in the AMERICAN MACHINIST.

FOUNDRY METHODS UNPRODUCTIVE

It seems to me that the methods used in the general run of foundry work have not kept pace with the advances made in other lines of mechanical work. I mean by this that no machining has been eliminated. The many experiments now being conducted to make permanent molds

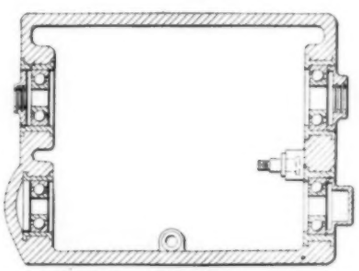


FIG. 5. PROPOSED METHOD OF MOLDING A CHANGE-GEAR BOX

seem to me to be a big step in the right direction. These molds would produce castings far more uniform than the ordinary sand molds can. Cast-iron molds for aluminum, and even cast iron, are now being used successfully.

Yet I think that much machine work could be saved by carrying these experiments a step further. Trusting my youth and inexperience to shield me from some of the criticism that an older man might expect, I have a possible method to suggest. Perhaps it has already been tried and discarded. But I have heard that a modification of this method is being used successfully today.

Many of the castings used in the course of manufacture have a few accurate working points while the rest of the casting is but a frame to support these working points in their proper relations to each other.

The intricate and expensive steel dies used to produce die castings would be of no value when brass or cast iron is to be cast because of the high melting points and shrinkage of these metals. The extreme accuracy of die castings in every particular is not necessary for ordinary work, although it would never be a fault. If the working points could be held accurately, the body of the casting could vary and be more or less rough without affecting the usefulness of the part.

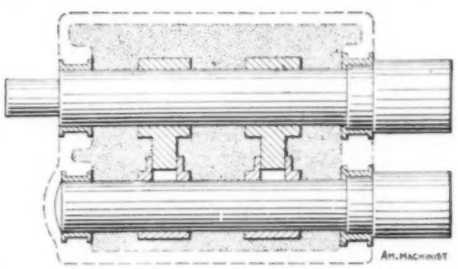


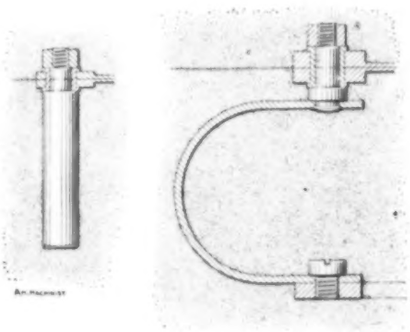
FIG. 6. SECTION OF CORE, SHOWING FIXTURE CARRYING BUSHINGS

CASTING TO ELIMINATE MACHINING

The method that I have to suggest, stated briefly, is this: To produce the finished working points on the casting let studs or bushings be cast into the piece in their proper positions. These studs or bushings could be cheaply and accurately made on screw machines or turret lathes. To hold these finished parts in their proper relation to each other, some provision must be made for holding them in the mold or core.

Experiments would be necessary to determine the method for holding the bushings, the proper allowances for shrinkage, etc., so that the bushings would be in their proper positions when the casting is cool. I am assuming that the shrinkage in several castings from the same patterns and the same metal would be equal. Such a process, if successful and practical, would enable parts, now made in several parts to facilitate machining, to be made as a single piece, thus saving the machining now necessary to assemble them.

The part to be manufactured is shown in Fig. 1. At *A* and *B* are bearings and



FIGS. 3 AND 4. TWO METHODS OF HOLDING PARTS

at *C* is a stud for a spring. The ordinary method of machining this part would be to mill the bosses and to drill the holes. The same piece, manufactured in the manner that I have suggested, is shown in Fig. 2. At *A* and *B* are the bushings and at *C* is the spring stud. These parts are all screw-machine parts, held as close to size as necessary and cast into place. No machine work would need to be done upon this part after it came from the foundry. It might be as cheap to produce this particular part in the ordinary way, but I have chosen this simple piece purposely to more easily explain myself.

HOLDING FINISHED PARTS IN THE MOLD

The next consideration is to provide a way of holding the finished parts in the mold. Several methods present themselves, and experiments are necessary here to determine the most accurate and

least expensive. The simplest method that I now think of is shown in Fig. 3. A long rod carrying the bushing at one end is placed in the mold and the sand is rammed around it. A hole in the pattern would serve to locate it in its proper position. The giving of the sand would allow the shrinkage. Where the shrinkage is slight, this method would probably prove satisfactory. But if the shrinkage were great, this long rod might tend to twist the bushing out of parallel. If this should prove true, another type of holding mechanism would be necessary.

A more elaborate method is shown in Fig. 4. Instead of single rods a frame would be needed carrying the spring arms as shown. These arms would probably be tempered and should be just stiff enough to hold the bushings from being displaced by the molten metal as it flows into the mold, and yet flexible enough not to develop any stresses in the cooling and shrinking metal. The frame to which these arms are to be attached should be of a skeleton type so that there would be no difficulty in ramming the mold. Where a molding or jarring machine is used the frame could be of a more solid construction as the sand would fill in around it without much trouble. It is probable that these arms should be so placed as to point toward a common center to which the metal would naturally shrink.

ANOTHER METHOD

If this type of fixture should not prove satisfactory and the bushings should come out of parallel, still another scheme might be successful. This would be made by constructing the arms so that they would be held parallel mechanically and yet be allowed to draw together as the metal shrunk. Where a core could be used, it seems as though the best results would be obtained by placing the frame in the core, thus eliminating all special work on the mold.

A change-gear box for an automobile that might be made by this method is shown in Fig. 5. This would give a light aluminum frame with steel working points, a desirable feature to my mind. This part would practically be finished when it came from the foundry. A section of the core showing the fixture carrying the bushings appears in Fig. 6. The stud for the reverse gear could be held by some type of arm such as I have described.

In all cases I am not attempting to go into details, but am trying to give a general idea of my suggestion. The large rods carrying the bushings could be made hollow if desired, but in all cases they should be so strong that the bushings could not possibly be forced out of line. The bushings should be allowed to slide on the rods on account of the shrinkage, and any slight variation in this direction should not matter much as the construction of the change-gear mechanism could take care of this. After the piece was cast the rods would be drawn out through the bushings while the rest of the frame could be taken out through the hole in the top through which the gears would be assembled when the part was finished.

In all cases the bushings and frame would be located in the mold or core by holes placed in the pattern or core-box for that purpose. The arms carrying the bushings should be so constructed that the bushings could be readily and easily placed in position. This is work that could be done by a boy; therefore this extra work in the foundry should not begin to cost as much as the ordinary machine-work would. Of course, there is the cost of the bushings to be considered, but these are screw-machine parts and comparatively inexpensive.

This method, if successful, would have many of the advantages of the die-casting proces. There would be a great saving of floor space and machinery, and any loss due to spoiled parts would be reduced to a minimum as the metal would be remelted, and the labor cost should not be very great.

EARLE BUCKINGHAM.

Hartford, Conn.

To Get Even Shrinkage When Babbitting

A piece of 1¾-in. shafting with bearings is shown in Fig. 1. A small gear wheel fills the space between *B* and *C*.

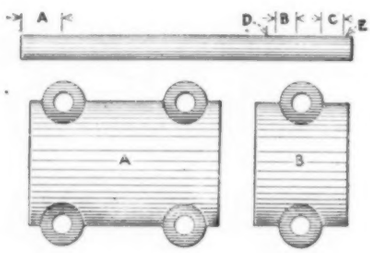


FIG. 1. TYPE OF SHAFTING BABBITTED

We have a great many of these to babbitt and several men on the job. Iron collars were fitted on the shaft at *D* and *E*. As the distribution of metal is the same around each bearing and the babbitt is only ¼ in. thick, there seemed no reason to expect serious trouble with unequal shrinkage, yet we found that *C* was invariably lower than *B*.

We pour top and bottom at once, with a nicked shim to separate them. We tried pouring the three in every different rotation, but with the same results—*C* low the thickness of a paper or two.

The reason finally determined for this was that the metal strikes the top of the shaft at *B* almost red hot; by the time it gets to the bottom it strikes the iron surrounding the bearing and is comparatively cool. The result is that the shaft is warped upward at *B*. If the three are formed in the order *A*, *B*, *C*, with a wait of a minute or two between *B* and *C*, to let the heat distribute itself, the shaft will straighten and the bearings will be in line without much scraping.

A sort of chuck devised to hold the caps of these bearings while scraping in is shown in Fig. 2. These bearings are required to fit snug without any shims. We pour with one shim to separate the top and bottom babbitt. It is, therefore, necessary to try them on and off and scrape quite a number of times. Our work is often at some distance from the bench.

Bearing caps corresponding to the bearings *A* and *B*, Fig. 1, are shown at *A* and *B*. A large cast-iron building washer is shown at *C*. In this are set three studs, with shoulders made by slipping a short piece of pipe over the stud and pouring full of metal. The washer is dropped onto a convenient stud on a larger bearing and fastened with a nut at *H*.

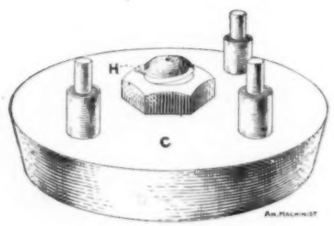


FIG. 2. CHUCK DEVISED TO HOLD CAPS

The cap *A* goes on all three studs, while *B* goes on two only. The shoulders hold the cap level. This arrangement is very handy. It is much easier to drop the cap on the studs (no units are necessary) than to walk to a vise and pull the vise tight every time. Besides where the light is poor, the whole thing can be turned on the stud at *H* to suit.

Milwaukee, Wis. S. FARIS.

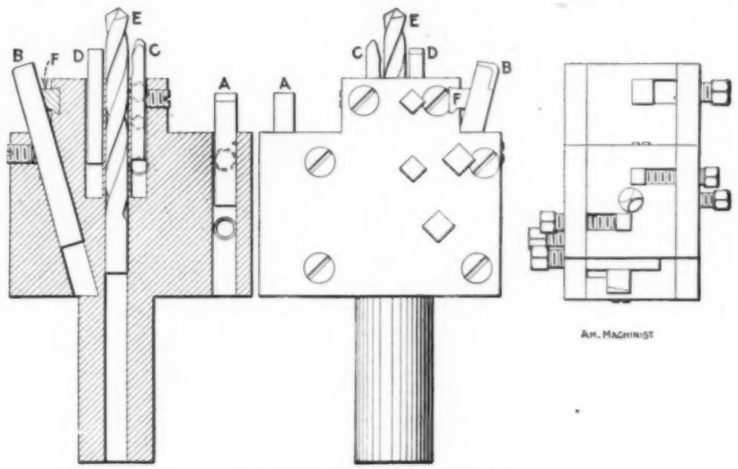
Multiple Cutter Box Tool

Where formerly, we performed five operations on a casting by using five separate tools and as many tool-holders and turret holes, we now produce the same operations with one tool and one turret hole. This is accomplished by the use of the multiple box tool shown in the cut.

The cutters *A*, *B*, *C* and *D* are made from high-speed steel, the points ground to suit the operation each has to perform. The tool *A* is ground on the point for facing, *B* for boring, *C* for turning off the side of the center projection to the angle shown, and *D* for facing the center projection.

A drill *E* drills a hole through the center of the casting. Each cutter is

set in the holder, after grinding, to the proper gage depth; thus the tool obviates the necessity of using the separate stops on the turret slide, as each operation is brought to size by one movement of the carriage.



MULTIPLE-CUTTER BOX TOOL

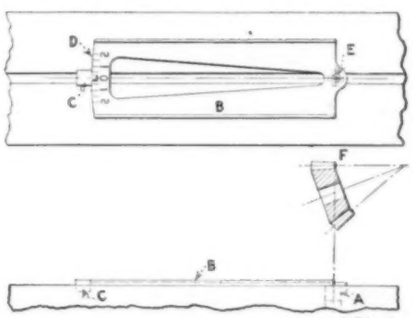
The wedge *F* with a very slight taper is for making slight adjustment of the cutter *B*. The slot into which the cutter *B* is fitted is milled to allow of a side play for the cutter when making adjustments.

A. R. COOPER.

Marshalltown, Iowa.

Bevel-Gear Cutting Attachment for the Universal Miller

The following description of an attachment for cutting bevel gears may prove interesting to readers having such operations to perform.



BEVEL-GEAR CUTTING ATTACHMENT

A block *A* is made to fit the slot in the table and has its upper part turned. A plate *B* is made to fit the universal head of the miller, allowing the head to slide into any position required. The block *C* is made to fit the slot in the table and has its upper front face provided with a center line. A scale *D* is formed on the back end of *B*. The hole *E* is reamed to fit the turned part of *A*. The front end of the teeth to be cut is represented by *F*.

By setting the universal head on the plate *B* so that *F* comes directly over the center of *E* the center of the cut at *F* will revolve as on a dead center requiring no side adjustment of the table if the cutter is of correct size.

Having the attachment 20 in. from the center of *E* to the scale *D* and the gear tooth 2 in. long, requiring 0.06 in. to be taken off each side of the tooth, the scale would have to be set over to read 0.6 in. right and left alternately for the two cuts.

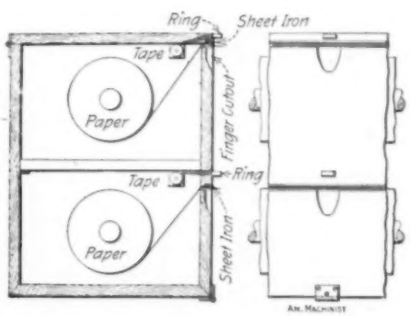
After these two cuts have been finished the operator can help the filing considerably by placing the mechanism back on the center and running a cutter of the correct pitch for the small end of the teeth in far enough to show the correct shape as a guide for the finishing.

J. A. WRIGHT.

Winnipeg, Canada.

A Combination Paper Box

The cut shows a combined blueprint and drawing-paper box. The top and bottom sections are used for blueprint and drawing paper, respectively. The roll is placed in the center either way, unwinding at the bottom and coming out under the lid.



COMBINATION PAPER BOX

A tape rest is fastened under the cover in the center, allowing the paper to be measured and thus saving many yards of paper. Notice the way the tape is run through the cover. This is done to prevent the line from going back into the case, as it is stopped by the ring. The end of the lid is edged with a piece of $\frac{1}{16}$-in. sheet iron which insures a sharp edge and produces a cleaner cut than the ordinary wood cover. The front of the box is cut at both ends to insure a better grip.

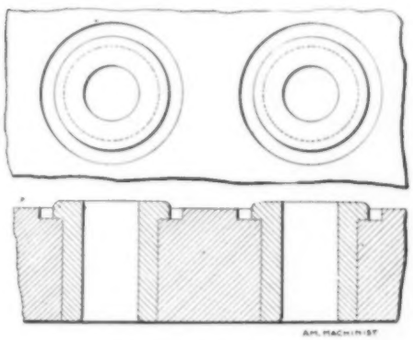
The blueprint section is painted black on the inside to preserve the paper. The lower section has the same features, the only difference being in the opening of the box in the front instead of on the top.

FRED FRUHNER.

Milwaukee, Wis.

Spot Facing Bushing Seats

I had two holes to drill and locate from a flat surface. By counterboring, or spot-facing, around the holes and reversing the bushing I was able to do away with finishing the entire surface. On particularly close work the heads of the bushings can be ground even after hardening.



SPOT FACING BUSHING SEATS

Lansing, Mich. L. DRAKE.

A Safety Device for the Press

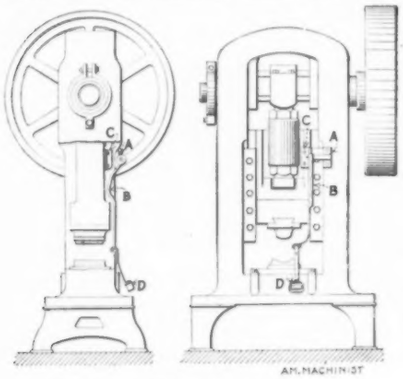
The safety device illustrated is one that we have used for a number of years. It is very simple to make and attach to any hand-fed press.

It consists of a block *A* attached to the frame of the press, on which is pivoted the lever *B*. This lever is shaped, as conditions require, to be thrown outward by the cam-plate *C* on the ram of the press.

Attached to the lever *B*, by a leather strap, is a leather loop *D* through which the press operator places the four fingers of his right hand; the thumb remaining outside. The clutch-trip is so arranged as to be operated by his left hand. As the ram descends, his right hand is pulled away by the lever and strap.

The lever and strap are so designed as to permit the operator to pick the work

out of a box placed before him on the front of the press bed. As his left hand is engaged in tripping the clutch, and his right hand is positively held away from



SAFETY DEVICE FOR PRESS

the dies during a stroke of the press, it is impossible for either hand to be injured.

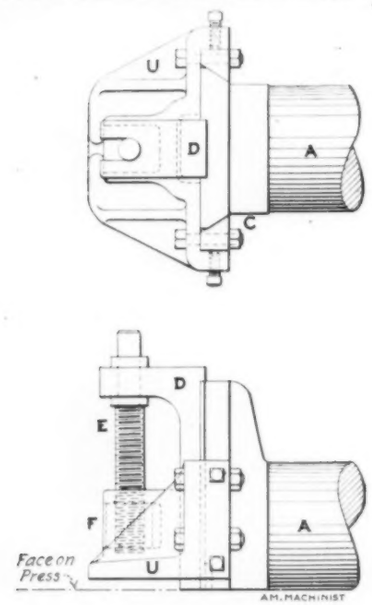
CURTISS F. SMITH.

Cleveland, Ohio.

A Plate-Curving Attachment on the Bending Press

The illustration shows an attachment on the bending press for curving to large radii plates of widths up to 12 in. The front end of the bending rams *A* has a double V on which a steel casting *U* is fitted with two loose pieces *C* insuring equal spacing of the bending points.

The bending buffers *D*, of forged and hardened cast steel, are secured to the rams *A* in the usual manner with counter-



A PLATE-CURVING ATTACHMENT

sunk set-pins, and have a lug on top carrying a square-threaded steel screw *E*. This screw operates in the nut *F* which is fitted in a recess in the casting *U* and permits the latter to be adjusted to suit the varying thicknesses of plates.

The large flat lower face on *U* is to prevent the plates from buckling. The attachment with the exception of the bending buffer is easily removed and the press can then be used for standard work.

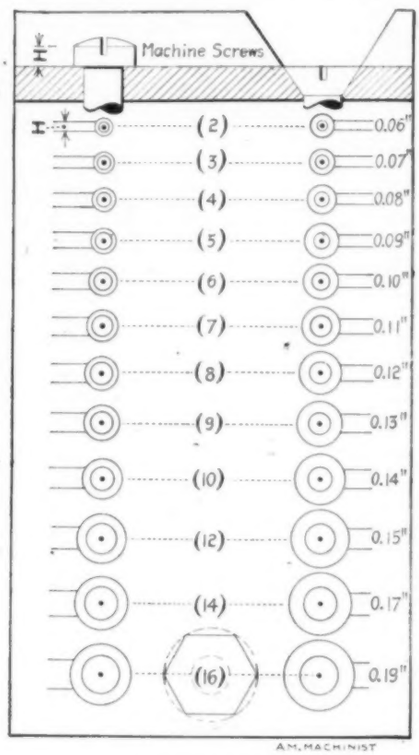
ANDREW ROBERTSON.

Montreal, Can.

Drawing Screws to Scale

Designers and draftsmen whose work involves the use of machine screws will find a surprising aid in drawing them to scale. The object of this is to furnish instantly, without the use of a table or scale, the various dimensions required to show a machine screw and its holes to size, and the minimum thickness of stock required for the use of flathead screws.

Use a piece of transparent celluloid about $\frac{1}{8}$x3x6 in. After squaring the edges, lay off, from tables given in the "American Machinist Handbook," and others, with a scale and trammel points,



MACHINE SCREWS

the circles as shown. Its use is apparent. The compass or dividers can be set directly.

In the left-hand column the inner circle represents the body of the screw, the outer circle, the diameter of a filister head, and the two horizontal lines *H*, the height of the head.

In the right-hand column the inner circle represents the body of the screw, and the outer circle the diameter of a flathead. The lines *H* represent the height of the flathead, and the dimensions show the minimum gage of the stock that will accommodate the head of that screw.

The numbers in the central column show the screw numbers for both of the outer columns, and the arcs on the side of the numbers are parts of a circle which would circumscribe a nut for that screw. The angles cut in the edge of the piece are for laying out the sides of the flathead. The gage can be laid out to various scales, but for half or double size drawings the compasses can change the scale.

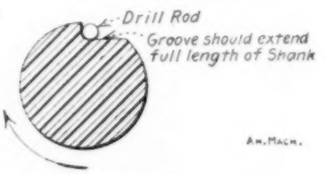
Steel number stamps leave a nice impression on celluloid. These letters, numbers, and the lines and circles engraved on the surface, as well as the center-punch hole, can be filled with black ink, which makes them stand out nicely.

E. B. BIRKENBEUEL.

Portland, Ore.

Saving Drills with Broken Tangs

A great deal has been said about restoring the usefulness of broken-tang twist drills. The following scheme has come to light in our toolroom for the redemption of such tools as have broken tangs. This, of course, includes reamers and special tools having a taper shank.



SAVING DRILLS WITH BROKEN TANGS

A glance at the diagram reveals the scheme. The slot or groove for the pieces of drill rod is usually ground by hand on the emery wheel. The roller lies loose in the slot, not being fastened in any way.

When the drill is about to be inserted the roller is placed in the groove and both inserted together.

It is evident the harder the pull the tighter the grip.

Lima, Ohio. P. STEINER.

If you want to interest a business man in any subject today you must show him that it touches either his business interest or his humane spirit. Every change in employers' liability laws which has ever been made in any country in the last 50 years has increased the financial burden of the employer. The changes and the increase in cost have been more rapid right along. It is, therefore, a business proposition for industrial organizations to acquaint their members with the present status of employers' liability and workmen's compensation laws in the United States and in foreign countries, and to advise them how the changes affect business and what position should be asumed in connection with additional contemplated changes in such laws.

Discussion of Previous Question

Referring to letters and articles previously published

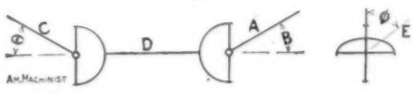
Angle for a Universal Link

In reply to Mr. Stockholm's question, Vol. 36, page 539, in regard to the maximum angle between shafts connected by a universal coupling, I would say that the coupling will work at any angle up to 90 deg. However, the closer the angle is to 90 deg., the greater the variation in the angular velocity ratio of the two connected shafts.

The angular velocities of the shafts *A* and *D* are to each other as

$$\frac{Cos.\ \beta}{1 - sin.^2\ \phi\ sin.^2\ \beta}$$

where β is the angle between the shafts and ϕ is the angle that either arm is off the quarter point, as shown in the figure, where *E* is the position of the arm



DIAGRAMMATIC DRAWING OF UNIVERSAL COUPLING

when the velocity is being figured. If the driver *A* rotates uniformly at unit velocity, the velocity of the driven shaft *D* varies from $\frac{1}{cos.\ \beta}$ to $cos.\ \beta$ during each quarter revolution.

If the shafts are in a straight line, the velocities of the shafts are always equal. If the angle between the shafts β is 45 deg., the velocity of *D* varies from 0.7 to 1.4, and if β is 75 deg., the velocity of *D* varies from ¼ to 4, and if β is 90 deg., the velocity of *D* would vary from 0 to infinity, which is, of course, impossible, as common sense would tell without this analysis. The ratio of the forces in the shafts varies inversely as the velocity ratio.

If two couplings, with their forks in the same plane, are used, and the intermediate shaft makes equal angles with the other two, that is, angle θ is equal to angle β, the velocity of the last shaft *C*, will always be equal to that of the driver *A*. The second coupling neutralizes the effect of the first. The only limit in this case is the force that the intermediate shaft and the couplings will transmit. It is evident from the foregoing that the maximum angle, in any particular case, is limited by the requirements of the service.

GEORGE L. SULLIVAN.

Bozeman, Mont.

Drawing-Board Improvement

With a view to the care and preservation of a drawing, it would seem that the suggestion of Mr. McAlpine for handling long drawings on a small board, Vol. 36, page 427, under the above title, might be slightly improved. A disadvantage in the idea offered is evident from the fact that the T-square bears directly upon the edge of the drawing at the opening; if the work is executed with the drawing in the same position for any length of time, a crease or permanent crack would result. Especially would this be true in the case of a tracing.

By effecting the improvement in the board parallel to the working position, as shown in the illustration, the possibility of any damage from the T-square would be eliminated, while the opening would tend precisely to the same purpose. The edge of the opening should be slightly rounded on the side along which the drawing rests, thus offsetting any chance of injury. This latter feature would also act effectively if embodied in the suggestion of Mr. McAlpine.

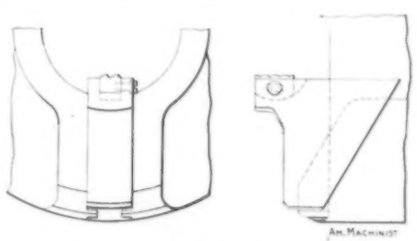
The addition of a small wood roller beneath the board, on the principle of a shade roller, to take up the drawing as required, instead of allowing it to hang free below the board, will also render aid in keeping the tracing in good condition. The roller is, of course, supported on the under side of the board.

L. ARMSTRONG.

Los Angeles, Calif.

Chuck with Swivel Jaw

In Vol. 36, page 77, a chuck with swivel jaw is shown. The line engravings herewith show a similar but simpler device, of which we made a number during recent years and applied them to the



CHUCK WITH SWIVEL JAW

jaws of the spiral self-centering chucks which we manufacture.

In addition to its use for holding taper articles, this chuck is also very useful for holding any article on which the part held is likely to be out of true with the other parts, and so requires to be set true, as, for instance, the hexagon head of a bolt.

CHARLES TAYLOR, LTD.

Birmingham, England.

What Is a Draftsman?

What is a draftsman? What is an engineer? The answers to these queries bring out the point that in this day of specialization simple names no longer define; there must be some qualifying word or phrase coupled to the old-fashioned terms to limit and more clearly define the special fields of activity into which the professions have become divided. What is a structural draftsman? What is a mechanical engineer? It is easier to answer these queries; the qualifying word or phrase has been added.

Of course, there is a general answer to the query "What is a draftsman?" and the editorial in Vol. 36, page 685, has given the general answer. But this is an age when generalization is not sufficient; it is an age when specialization is demanded and justly so. Because one man can do one thing better than other men, he succeeds, and industry succeeds because of his concentration. And so long as this condition exists—and it is a condition which seems destined to exist because of the results obtained by its application—it will be impossible to make general definitions serve.

"Primarily a draftsman must know how to draw" is a truism, but it defines only one qualification a draftsman must have. "A draftsman is one who makes drawings" is likewise a truism, but are these drawings house plans, bridge details, machine drawings, or cartoons? The qualifying word or phrase is needed to limit the field of activity, to specify more closely the nature of the work.

There is an essential difference between designing and drafting; it is the difference between creating and describing. Also there is a difference between drafting and tracing; it is the difference between describing and copying. But who is to say when a draftsman *is* a draftsman, and who is to say when this man who makes this *kind* of a drawing is a certain kind of draftsman? It would seem that there might be some more generally understood and more widely accepted terminology to indicate tersely and exactly the character of such work and the rank of such workers. The task of defining and classifying might well be assumed by the American Society of

Engineer Draftsmen, for their verdict in such a matter would have the weight and authority of an organization behind it and this would go far toward its general acceptance.

Iowa City, Iowa. F. G. HIGBEE.

The Boy's Income

A hasty reading of the editorial on page 849 would lead one to think that the editor and myself were at variance over a very important and vital matter. Like many other such cases, however, there is no fundamental difference of opinion but only a variance due to our use of terms which as yet have no absolute definition.

Attention should also be called to the fact that most new things are heralded by their over-enthusiastic friends as panaceas for all the ills of humanity and that they thereby suffer until the time is reached in their development when they can be seen in their true perspective and measured up against other things in true proportion.

Industrial education of any and of all kinds is not going to work a revolution in the ways of the world of manufacture and none at all, relatively speaking, in that of commerce. We lament the fact that less than 2 per cent. of the pupils in schools today are to graduate from college. We do not stop to think that probably that is very nearly all of the people who could really benefit from a college education, though we painfully realize that some of that 2 per cent. do not make the best possible use of that education.

What percentage of the school population could profit from the training offered in the full-time trade schools, such as those covered in the article referred to in the editorial? The number of boys and girls who are in the industries is about 6 per cent. of the school population. The number in high schools and colleges together is about the same.

These latter will not form a large recruiting field for industrial education because most pupils who enter high school do so with the intent to follow some profession or to enter commercial life. Therefore the field is largely restricted to those who leave school early and enter the industries. Of these many necessarily enter industries so low in the scale that no trade training worthy of the name can be given them. They are of so low a mental grade that they would only be injured rather than helped by a training which they could not absorb and which would only encourage them to enter industries in which they would from their natures be so inefficient that they would soon be thrown out.

For such pupils, however, a great deal can be done in the way of social work which will make their lives better and help to make the next generation much more useful to themselves. One man's guess is perhaps as good as another's but it certainly would be fair to assume that if full-time trade schools ever take care of 5 per cent. of the school population they will be doing all the work that there is for them to do.

Half of these being girls with whom we are not concerned at present, there remain in Massachusetts about 12,000 boys who should fairly be helped by trade training. At the present writing there are approximately 1000 boys being so trained, there having been several schools approved in the last month or two.

At the rate at which the schools are increasing their registration the total of 12,000 would be reached in about five years, which is certainly sooner than the requisite schools can be established and manned. In order to keep up the present rate of growth, however, it is going to be necessary to make it possible for boys to work their way through the schools. Let us see if there are any ways in which this can be done without resort to the Fitchburg plan.

BOYS WORKING THEIR WAY

It is well known that many boys work their way through high schools, colleges and technical schools. How do they do it? Simply by the use of their spare time. They seldom work at anything that has a close relation to the profession to which they are aspiring, because that kind of work is not usually available. They have the spare time, however, and that is the thing which is preventing many boys from getting a four-year training in a trade school, whereas these same boys, if they had the fitness, might easily work their way through eight years of high school and technical school.

This shows us that in an attempt to make the trade schools practical and efficient we have made them impractical for many boys. We must moreover admit, judging by the after success of technical graduates who have worked their way through school, that the trade-school boy who worked his way ought to be an especially fine product, and one that we cannot afford to miss. One way to accomplish this result is so to shorten the hours and terms that a boy would have a chance to earn his way.

A HALF-TIME PLAN IN A FULL-TIME SCHOOL

We would all be willing to grant that it would be to the boy's advantage to secure work similar to that on which he is being trained, or rather that on which he has already been trained, so that he could put his training into practice immediately, and secure the best results of that training by practice under commercial restrictions as to speed and quality. If he could do that then his actual time under instruction could be materially reduced, as the time now being given to practice for dexterity's sake could be almost entirely omitted. This can be accomplished in either of the following two ways:

By a half-time plan (not the Fitchburg plan to which the editor evidently refers when he speaks of the half-time plan) by which the boy would have effective instruction in shop practice in the school under instructors whose business is to instruct rather than to get out work, and whose work should be organized on the most intensive possible basis, with little or no reference to the amount of its ultimate value, but with close adherence to its being of some value.

He should also have an equal amount of classroom instruction calculated to make of him a better and more efficient workman and citizen. These two phases of his education should occupy half his time. The other half should be spent in some shop where it would be accepted that he was to be put only on work for which he had already been trained in the school and paid what he could actually earn and not enticed into leaving the school.

We are experimenting in a very small way here at Worcester with two of our boys. They are or will be pattern makers who have had enough training to be of some real value in any shop but who have by no means absorbed all that we have to offer in the way of instruction. They are drawing as much pay for the week in the shop as would be paid for two weeks in any apprenticeship system, but there is no intention that they should be taught anything in the shop. They work there for what they are worth on work with which they are familiar, and they are acquiring dexterity. In the school they are learning how and why to do things and are getting a general all-around education. Of course, this experiment is too small to determine whether it is a successful way of handling the matter, but it has not yet shown any weak points.

PAYING WAGES IN A FULL-TIME SCHOOL

The second way is by paying wages in the school shop. This sounds impossible but I believe that the following plan has the merit of being interesting even though I can see difficulties in the way of administration. It should first be borne in mind that the normal boy has in him, deeply concealed to be sure, a considerable potentiality for useful work. This work is detached from him in a shop by the lure of wages and by the force of a foreman's bullying. Neither of these things has so far been successfully introduced in schools, though the latter has been given many trials.

In Worcester we find that it costs the community 15 cents per pupil per hour in the shop to run the school. This, however, includes materials as well as classroom instruction. Eliminating these it costs a little less than 10 cents to keep each boy in the shop each hour. If a boy earns over 10 cents in an hour he

really ought to have that surplus or some part of it, since no charge for interest or sinking fund for the school buildings is included in the above estimate.

Suppose we have a job in the shop, say a lot of gears for the making of which we receive a fixed sum, we will divide it between the different operations and we find for example that on some one size of gear we are getting 10 cents for the turning alone. Now if a boy turns that size gear every hour he manifestly is paying his own way. If he turned two gears per hour he would be earning 10 cents per hour over and above his cost. Why not divide it with him and give him 5 cents per hour, always bearing in mind that there are fixed charges being carried by the community that do not directly appear on our books?

If we should do this we would be paying him wages, not out of the public funds but out of the money which he rightfully has earned. By his useful labor he has created a value. The community has helped him to do it by putting the opportunity before him and he has taken advantage of it. Is there any reason why he should not take it?

Someone will doubtless say that we ought to be able to make the school self-supporting, and that if we cannot do this now we ought not to expect the boys to earn so much more than they do at present simply because we might offer wages. These people should remember that we are handicapped by the traditions of schools which for centuries have been burdened by the attitude of pupils and parents who regard such schools as the one place where it was proper to see how little one could get for his money.

I firmly believe that it should be made possible to try this experiment, in which we are handicapped by the letter of the civil service laws of Massachusetts. It would, of course, be necessary as a matter of administrative detail to draw the line sharply between practice and productive work, but this has been done for years at Hampton with colored boys, and I dislike admitting that our white boys are any less amenable to reason than they are.

It will be seen that both these plans are practically alike except for the detail that involves the location of the shop in which the boy earns his money. Some will say that it is impossible for a public school to carry on an actual commercial shop at all. We believe that we are doing it here. At all events we welcome unbiased opinions from practical sources as to that.

Unusual Community Conditions Are Necessary for the Half-time Plan

The Fitchburg plan may be very aptly named a half-loaf plan as copied outside of Fitchburg. The simplest justice demands, however, that we give Fitchburg credit for making it more than that in its own case. As stated before, Fitchburg has made this scheme a creed which it must and does live up to.

Fitchburg is fortunately situated in many ways that are not duplicated to any great extent in other cities. It has a small group of closely associated manufacturers, all practicing similar trades. It is practically able to pick the boys from the city who will likely make the best mechanics and to refuse them admission to their shops as apprentices unless they take up their part-time plan of education.

As stated in the original article boys are not likely to take up with any part-time scheme which means any considerable loss of income—once they have had one—for what appears to them to be merely book learning. The plans outlined for appealing to these boys will, I believe, be free from that objection, in that half of their time in school will be taken up with actual work, the advantage of which is immediately apparent to the boy, and because it most certainly puts the boy in a position to secure greater pay than he can get under the Fitchburg plan and probably makes him worth as much in his alternate weeks as the ordinary apprentice is in full time.

I appreciate that the AMERICAN MACHINIST has stood for the Fitchburg kind of part-time training for a long time, and I also appreciate the spirit of fair play which has impelled it to give the advocates of other forms of industrial education an opportunity to advocate their views. The Fitchburg scheme has had equal opportunity but it has not spread to anything like the extent that it must if it is to prevail. That it has not spread I believe to be due to the scarcity of cities where the manufacturers are willing to sink their individualities for the common good to the extent that the people of Fitchburg have.

While we deplore this fact it is also evident that we will have to continue to work with the kind of people among whom we are placed. If part-time education does not appeal to them it appears to be necessary to give full-time training.

Worcester, Mass. E. H. FISH.

Working or Unit Stresses for Design

The three theories taken as the basis of Mr. Trawe's article, on page 787, Vol. 35, have frequently been discussed in connection with formulas for shafts subjected to both bending and twisting, and since Prof. Guest published the results of his experiments on specimens made of soft-steel tubing, there has been much criticism in favor of the "maximum shear stress theory."

To use Prof. Guest's formula in designing a cast-iron shaft, or other machine elements of the same material, would be as erroneous as equating the bending moment in a beam of circular cross-section with the torsional instead of the bending resistance. There is but one fundamental consideration in the design of a machine or structure subjected to combined stresses, and that is to have the stress in any plane not to exceed the allowable working limit of that particular stress in that plane.

It is this consideration that dictates the thickness of a web in an I-beam, and makes it necessary to investigate beams for shear as well as for normal stresses (tension and compression). If the shearing resistance of a beam were enormously great, compared with the normal resistance, it would be only necessary to investigate the normal stresses. A cast-iron beam usually fails in tension, and not in compression, because the ultimate compressive strength is about five times the ultimate tensile strength, and it is not usually practical to design a cast-iron beam that has the same factor of safety in tension as in compression.

The Three Maximum Resultant Stresses

An element of a machine or structure may be subjected to three normal forces, producing three apparent normal stresses at right angles to one another, and there also may be a shearing stress, due to an imposed twisting moment. These apparent stresses cause resulting stresses in the body, and in certain directions these resulting stresses are much greater than any one of the apparent stresses.

The formulas usually given for finding the resulting stresses consider only one apparent normal stress p, and a shear stress q, acting at right angles to each other. This is the condition which exists in a shaft subjected to combined bending and twisting. The maximum resulting tensile stress, due to the apparent stresses p and q, is

$$p' = p/2 + \tfrac{1}{2}\sqrt{4q^2 + p^2} \qquad (1)$$

The maximum resulting compressive stress is

$$p'' = p/2 - \tfrac{1}{2}\sqrt{4q^2 + p^2} \qquad (2)$$

and the maximum resulting shear stress due to p and q is

$$q' = \tfrac{1}{2}\sqrt{4q^2 + p^2} \qquad (3)$$

These equations represent the resulting stresses in one plane, due to two apparent stresses p and q, acting in that plane, and as it is possible to have three normal stresses instead of one, they do not apply to every case of combined stresses.

Beside the apparent and resulting stresses there are others, known as equivalent stresses. The equivalent normal stress p_e, is a linear stress, which would produce a deformation equal to that actually produced in the same direction by the combined stresses, and is equal to

$$p_e = \frac{(1-n)\,p}{2} + \frac{(1+n)}{2}\sqrt{4q^2 + p^2} \qquad (4)$$

where n is Poisson's ratio of lateral contraction.

The Three Theories

The theories under discussion involve equations 1, 2 and 3, when the stresses are in the same plane. The theories may be stated as follows:

Maximum Normal Stress Theory—This theory is due to Rankine, who held that the yield point of a material subjected to combined stresses depended upon the maximum normal stress, and independent of the shear or other stresses present. According to this theory, yielding is produced by the maximum resulting normal stress p'.

Maximum Strain Theory—This theory is due to Saint Venant, and is based on the assumption that yielding does not depend upon the resulting stress or stresses in any given direction, but upon the deformation; that is to say, a material will not yield until the stresses have produced a certain deformation, which may be found by dividing the stress at the yield point by the modulus of elasticity. According to this theory, yielding is produced by the equivalent normal stress p_e.

Maximum Shear Theory—This theory assumes that the yield point depends upon the maximum resulting shear stress q'.

Saint Venant's theory embodies Rankine's theory inasmuch as the stress producing yielding is a maximum normal stress, and therefore may be considered a refinement on the "maximum normal stress theory." Guest and Rankine agree that yielding depends upon a single resulting stress, but differ as to the nature of that stress; the former assumes it to be shear, while the latter assumes it to be a normal stress.

The Choice of Theories

The question for the designer to decide is: Which of these three theories should I accept? Until the year 1900, he had only two, and it was easy to see that the "maximum strain theory" is a refinement of the "maximum normal stress theory," and slightly more accurate, but the "maximum shear stress theory" is quite different from the other two.

If someone would experiment with a material having a yield point in compression, much less than the yield points in tension and shear, he would have another one to select from, known as the "maximum compressive stress theory." The reason that this fourth theory has not been suggested is due to the fact that the compressive strengths of materials are usually greater or almost as great as the other strengths, except in certain kinds of wood. In all probability, this theory would apply to certain kinds of wood equally as well as Guest's formula applies to ductile materials and Rankine's to brittle materials.

Equal Factors of Safety

In designing a beam, we consider the apparent tensile and compressive stresses due to bending, and the apparent shear stresses, and desire to have the factors of safety in shear, tension and compression equal if possible. It would be more accurate to consider the resulting stresses, and still more accurate to consider the equivalent stresses. But such refinements require long computations and are necessary only in extreme cases.

Is it not just as desirable to have the factors of safety in tension, compression and shear equal in shafts and other machine elements as in beams? It is frequently impossible to have them even approximately equal, but in this event it is desirable to know the source of weakness.

Suppose the resulting stresses in a machine member are found to be $p' = 10{,}000$, $q' = 8000$ and $p'' = 7000$; the yield point of the material in tension is $P' = 25{,}000$, in shear it is $Q = 32{,}000$ and in compression it is $P'' = 35{,}000$. Then the factor of safety in tension is $F_t = 25{,}000/10{,}000 = 2.5$, in shear it is $F_s = 32{,}000/8000 = 4$, and in compression it is $F_c = 35{,}000/7000 = 5$.

According to the "maximum normal stress theory," the factor is 2.5, and the "maximum shear stress theory" gives a factor of safety of 4. From this it may be seen that the proposition of choosing the correct theory depends upon the resulting stresses and the yield points of the material in tension and shear. There being no "maximum compressive stress theory," the compressive stress at the yield point is eliminated.

To compare the theories of Guest and Rankine for stresses acting in one plane by using the factors of safety in shear and in tension as a basis, we have the ratios of the factors of safety

$$\frac{F_t}{F_s} = \frac{\frac{P}{p'}}{\frac{Q}{q'}} = \frac{Pq'}{Qp'}$$

From equations 1 and 3 it is seen that when $p = o$, $p' = q' = q$, and when p is greater than zero, p' is greater than q'; hence, q' can never be greater than p' if p denotes tension. The maximum value of $p'/q' = 2$, and occurs when $q = o$, and the maximum value is 1 and occurs when $p = o$. A material as strong or stronger in shear than in tension will fail in tension, regardless of the relative value of p and q.

This may be seen from the above relation for the factors of safety by making P/Q greater than 1; and since p'/q' may vary between 1 and 2, F_t/F_s may have any value greater than ½. For equal factors of safety, $P/Q = p'/q'$ or $Pq'/Qp' = 1$, and by substituting the values of p' and q', it is found that equal factors of safety in tension and shear occurs when

$$P/Q = \frac{p/q}{\sqrt{4 + p^2/q^2}} + 1 \qquad (5)$$

This equation represents the condition under which Guest's and Rankine's theories give the same results, and it is as correct to use one as the other when this equation is satisfied.

The refinement of Rankine's theory by Saint Venant does not affect the value of this expression greatly. In this case the condition for equal factors of safety is

$$P/Q = \frac{(1-n)\,p/q}{\sqrt{4 + p^2/q^2}} + 1 + n \qquad (6)$$

If the value of P/Q for the material is greater than the value of the right-side of this equation, the factor of safety is less in shear than in tension, and the "maximum shear theory" should be used. If the value of P/Q for the material used is less than this expression, the maximum strain theory should be used. If the apparent stress and yield points and Poisson's ratio for the material are such as will satisfy equation (6), either Saint Venant's or Guest's formula may be used, because they will give the same result.

This is equivalent to saying that the shear stress in a beam may be neglected if it is known that the factor of safety in shear is much greater than the factor of safety in tension, or the bending may be neglected if the factor of safety is known to be much greater in tension than in shear. If the factors of safety in shear and tension are known to be equal, it is immaterial whether we design for a given factor of safety in tension or shear; the result will be the same.

Then, in answer to the doubt as to what theory should be used in calculating the size of a machine element subjected to combined stresses in one plane, we have equation (6), which is a means of determining whether it is stronger in shear or in tension.

A. Lewis Jenkins.

Cincinnati, Ohio.

Punching Celluloid

Referring to Mr. Quad's article on page 91, on punching celluloid, I would suggest that he try a punch and die made the same as an ordinary punch and die for steel blanks, but leave the die soft and harden the punch. When the die gets dull, he can hammer it in and shear it to size with the punch again. This produces a good tight fit and a clean blank; many thousand blanks can be punched thus without touching the die.

Philadelphia, Penn. Fred Henke.

The "Principles of Management"

I believe that nearly all who are interested in the problem of shop management will find themselves in hearty accord with the spirit of the article on the "Principles of Management," by Messrs. Church and Alford on page 857. If there is anything which the literature of this subject needs it is a clearing away of the underbrush that obscures the root of the matter and getting a clean-cut separation of the principles involved and their practical application.

The early literature of almost any movement is likely to consist, to a large extent, of a discussion of phenomena and results rather than of basic facts, and the literature of the principles of industrial management are markedly of this character. It is so filled with examples of systems, cards, forms and special methods that many have acquired the idea that it is possible to build out in the shop yard, a system that will answer all needs, lift it up with the yard crane and drop it down, a perfect fit, over shop, machinery, and personnel.

This lengthy discussion of *methods* has done much to obscure *principles*. The work of Mr. Taylor has done much to call attention to the fact that there *are* basic principles which can be formulated, and the article under discussion will go a long way in furthering this line of thought.

One of the most important points brought out in the paper is the distinction between the basic principles of management and human characteristics. No man can make a success of any business without such things as common sense and its correlated virtues. Yet the ardent advocates of system, in their anxiety to build up an imposing structure, have often included many of these human attributes as part of their structure with the result that the principles at the bottom are almost obscured from view.

As the article in question clearly points out, the fundamental principles on which the science of management (if indeed it be science) rests, are few and comparatively easy to understand. The difficulty lies in formulating methods of applying them, in recognizing their limitations, and in estimating correctly the desirability of some of the effects produced.

Granted that the principles are clearly in mind, it is not easy to apply them particularly when the matters of personnel and personality are to be considered, as in general they must be. It is disturbing factors like these which make it impossible to lay down methods which are universally applicable.

Personality and leadership are still, as these writers have pointed out, the great moving powers of all organizations. Many discussions by advocates of so called "systems" lead one to believe that these necessities can be obviated by card systems and blank forms, overlooking the fact that "organization" can *strengthen* a strong leader but never replace him.

I have always been inclined to believe that many of the systems which can lay claim to success have often succeeded, not so much because of inherent good qualities, but because of the leadership back of them.

The points which they have raised regarding the limitations of all *systematic* effort are well taken. It is not so difficult to plan manufacturing tools and methods where quantity of product can be secured, but it requires rare discrimination and expert knowledge to know where to stop the organized effort for simpler methods as quantity decreases.

It is as easy to overdo as to underdo in problems such as these, and many of them cannot be reached by mechanical systems, but require the keen judgment of the trained mind to properly evaluate new methods and standards in terms of its own experience.

And lastly the thread of thought that runs throughout the entire article bearing on the relations of these matters to human affairs should not be passed unnoticed. The time has already come when methods cannot be adjudged solely on the basis of whether they will produce dividends. Industry is being viewed more and more as a general means of supporting human existence and not as a means of individual profit; and as this sentiment grows, details of industrial methods are being judged desirable or not desirable, depending on how they affect human relations rather than on the ground of financial profit or loss.

I believe the statement of the basic principles of progressive industrial organization set forth in the article in question is not far from the truth, and we are in need of more literature of this kind. We need discussions which are neither destructive criticism of any earnest effort on the one hand, nor devoted to the exploitation of some one expert or system on the other, but which aim to find out if possible just what is at the bottom of this weighty matter. For if the basic principles can be made clear, methods of applications can usually be found.

DEXTER S. KIMBALL.
Professor of Machine Design, Cornell University.
Ithaca, N. Y.

The concentration of discussion, largely upon one particular scheme of industrial administration and control, has been the natural result of the exclusive claims of its promoters.

Many possible adherents of the efficiency movement have been lost by insisting that "scientific management" is the authoritative and final word upon the subject and that its principles and derived elements should be applied "with no modifications and no deviations" to every class of industry.

As a matter of fact no such program has been found practicable, yet the attitude remains and is a principal reason for the destructive rather than constructive criticism which this particular system has evolved.

The time is opportune for considering, analyzing, and formulating the general principles underlying successful industrial practice without tying these up to the preferred detail of any particular set of practitioners.

ATTITUDE OF THE PRACTICAL MAN

One thing is clear, namely, that the men who have "to produce the goods" daily, reject the idea that a pink pill has been discovered for all pale plants; they will not entertain it under any label.

It offends their common sense. It also leads to injurious reaction against perfectly reasonable efficiency measures and hampers sympathetic and capable administrators in their promotion of betterment.

It would be a great pity if the very fertile generalization which we owe to the arduous labors of Mr. Taylor, should fail of acceptance because of intolerant or arbitrary insistence upon a system of detail which takes no account of the variety of industrial conditions and problems.

THE FUNDAMENTALS

For this reason the recent endeavor by Messrs. Church and Alford in your pages to outline the fundamentals of practice, without asserting any proprietary interest or introducing a mass of debatable details, is likely to interest the great mass of executive employees. The views set forth by these writers are lucid, well considered and concise.

They well deserve, and will receive the careful attention of progressive engineers and production managers. Their analysis covers the basic ideas and motives underlying all deliberate industrial coördination and also much, more or less unconscious, practice.

The fundamentals have been correctly reduced to three independent principles of action in management, namely: Systematized experience; economized effort; and developed personality; all raised to the highest power consistent with economy, and the business and human factors peculiar to any particular administrative problem. These principles and their natural derivatives are so fully and satisfactorily outlined that they call for neither criticism nor further expansion here.

The insistence, at great length, upon the details of particular shop manage-

ment systems has in the past merely darkened counsel or raised debatable issues. Your contributors have been well advised in their endeavor to find what is common to all such business problems, and their clear-cut analysis and philosophy is capable of very wide application.

LEADERSHIP

Your correspondents do well to emphasize the human elements in the success, or otherwise, of the best laid schemes of industrial economy. In the course of actual practice the existence of even a perfect scheme will not insure that the fundamentals and their derivatives will be all evenly developed. They rarely are and this may occur under the best system. To attain the ideal, the supervisory staff must be organized and competent to a degree which no mere system of actions can guarantee.

THE ULTIMATE GOOD

The ideal conception of work is that it should be the spontaneous expression of a man's best impulses. When it is, instead, a more or less grudging participation in what is felt to be daily drudgery there is something wrong with the man or the work, or possibly with both. There is nothing in the true principles of good management, or in their derivatives, from which the workman has anything to fear.

Less discussion of the details and more thorough practical application of them by wise and competent administrators will not herald the millenium but they will convince the largest and most reasonable section of our American workmen that they are getting at all times from such employers an absolutely square deal and that they ought to expect nothing less and nothing more.

Detroit, Mich. JOHN CALDER.

Welding A Broken Crank-pin

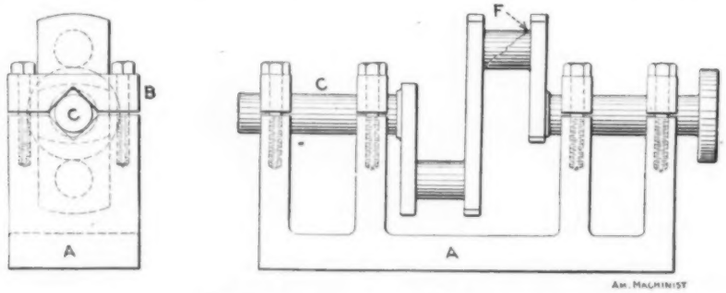
In reply to the query, "Can This Crankshaft be Repaired?" in Vol. 35, page 1135, I may say that I have had several experiences with repairing motor cranks.

The last one was on an 8-hp. car. It broke diagonally across the rear crankpin. I had no difficulty getting it electrically welded, so long as it was held in a correct position and true, during the operation. This was accomplished by means of the fixture shown herewith.

A cast-iron fixture is shown at *A; B* are caps on the fixture; *C* is the crank to be repaired; *F* is where the fracture occurred. It will readily be seen that where the crank is held the bearings are shaped, milled out in a true line, both top and bottom, so that when the crank is placed in position, it is securely held by screwing down the eight $\frac{5}{8}$-in. setscrews, thus holding the crank in a convenient position for getting the nozzle or carbons necessary for the welding operations. Sufficient material is welded on to allow the crankshaft being turned to standard size again.

M. MAPLETHORPE.

West Bromwich, England.



THE SHAFT AND THE FIXTURE

Length and Diameter of Spring

The following is offered as a solution of P. Steiner's question, in Vol. 36, page 531. Referring to Fig. 1, let

l = Length of spring (on center line);
δ = Thickness of spring;
d_1 = Diameter of inside coil;
d_2 = Diameter of inside coil;
n = Number of coils;
d = Diameter of shank or arbor.

It is readily seen that within practical limits

$$l = n\pi \frac{d_1 + d_2}{2}$$

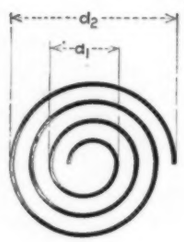


Fig. 1

If we assume the spring to be wound tight around the arbor, Fig. 2, we have:

$$d_1 = d + 2\delta$$

$$d_2 = d + 2n\delta$$

$$\frac{d_1 + d_2}{2} = d + \delta(1 + n)$$

whence

$$l = n\pi [d + \delta (1 + n)]$$

Substituting Mr. Steiner's figures:

$$l = 3.5 \times \pi [1.25 + \tfrac{1}{32} \times 4.5]$$
$$= 15.29 \text{ in.}$$

To this length of the active spring has to be added a certain amount at *A*, on which to fasten the spring to the arbor, and on the other end of the spring a certain length *BC* (tangent to the outside coil), which connects the outside coil with the spring case, and again a certain length *CD* on which to fasten the spring.

The second question raised by Mr. Steiner is easily answered. The inside diameter of the spring case has to be such that the rivet heads *H* (Fig. 2), or other means of fastening the spring, clear the outside coil of the spring when the latter is wound tight around the shaft. If *h* designates the height of the rivet heads, etc. (Fig. 3), we would have:

$$R > \frac{d_2 + \delta}{2} + h$$

and, substituting the above found value of d_2:

$$R > \frac{d + 2n\delta + \delta}{2} + h$$

If *D* designates the inside diameter of the spring case:

$$D = d + \delta (2n + 1) + 2h$$

which, in the special case we are considering, would give us:

$D = 1.25 + \frac{1}{32} \times 8 + 2h = 1.5 + 2h$

It will be safe to make *h* at least $\frac{1}{16}$ in., even if there are no projecting rivet heads, or, in other words:

$$D = 1\tfrac{5}{8} \text{ in.}$$

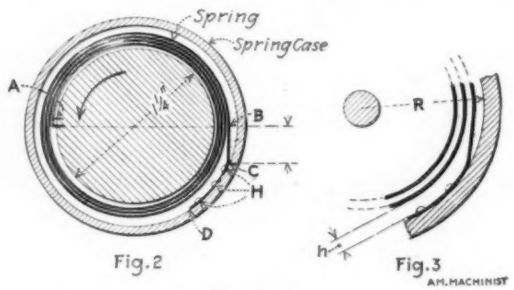


Fig. 2 Fig. 3 AM. MACHINIST

SPRING LENGTH AND DIAMETER

WILLIAM A. ROSENBERGER.

Brooklyn, N. Y.

At a recent meeting of the New England Foundrymen's Association a committee was appointed to look into better fire protection and insurance rates for foundry properties. It is the intention of the committee to study the whole subject of fire protection in foundries, with particular reference to improving conditions and thus securing better insurance rates. The main object, however, has the actual saving of property back of it rather than a mere adjustment of rates.

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OUTLINE OF TOPICS, PAGE 157

American Machinist

Museum of Peaceful Arts

We have frequently commented on the need of a museum of liberal arts and industry in the United States. A part of the project of the Smithsonian Institution at Washington, which has recently brought into being the new Museum of Natural History, was a development of such an industrial exhibit in the building of the old National Museum. Although the new building has been finished for a year, practically nothing has been done to straighten out the older one, and today it is but little more than a disordered storehouse. At the same time the Smithsonian authorities have recently acquired a number of very valuable exhibits, in the aëronautical field.

A new project has now been suggested. It is to erect a separate group of buildings in New York City for museums of peaceful arts. It is estimated that an investment of $20,000,000 will be needed. This group is to be "a great encyclopediac set of museums in the interest of higher education for our public schools."

The main suggestion is undoubtedly a good one for if the museum idea is worth anything at all, is quite as desirable to preserve the achievements of industry as the present and past of plant and animal life. But we have always believed that a great museum of this nature should be situated in our national capitol, rather than in any other place in the country.

To accomplish the most good, its purpose should be enlarged beyond that indicated by the quotation above. It should not only be looked upon as a means of education for public-school students but should present a complete history of industry for the use of inventors and industrial managers. The possibility of good from such exhibits in reducing re-discovery and re-invention is almost incalculable.

Are Twelve Hours a Day Too Much?

That the workings of the human mind are past understanding is borne out by the remarks of Judge Gary, president of the United States Steel Corporation, at its recent annual meeting. When a supposedly judicial mind can be responsible for the following remarks it is not surprising that those who have not had the advantages of education and judicial training will occasionally indulge in equally foolish remarks on the other side of the question. Judge Gary said:

> Personally, I am not certain that the 12-hour day is bad for employees, especially when they insist upon working that long in order to make more money. I was brought up on a farm, and many, many days worked more than twelve hours. I am sure that most busy officers of the company work more than 12 hours every day.

There can be no doubt that many of the men insist upon working long hours for the simple reason that their hourly wage is too small to enable them to live in any other way. Judge Gary does not discriminate between working twelve hours a day in the open air and the same length of time in the steel mills where the conditions are too well known to need description. And he also forgets his one day of rest and the occasional rainy day when he can go fishing without the loss of a day's pay.

It is barely possible that the men in the steel mills would be contented to work only ten, or even eight hours per day, if some of the dividends which are being paid on stock which has no right to exist, or some portion of the accumulated millions in the sinking funds, were added to the hourly wage so that they could exist in their present luxurious surroundings on eight hours' pay.

It is encouraging, however, to note that a vote in reply to a circular letter sent to 15,000 stockholders shows that 22 per cent. of these, for various reasons, would like to see a reduction in the hours of labor at the steel mills. This was in response to a protest by Charles M. Cabot, who proposed three shifts and an eight-hour day instead of the two twelve-hour shifts, seven days a week as now practiced.

In view of the position occupied by the United States Steel Corporation in practically controlling the output and prices of steel in this country, it is naturally in the limelight of publicity and it would seem to be policy to avoid antagonizing the general public in matters of this kind, unless indeed it feels that it is so strongly intrenched that it can disregard public opinion. Such an attitude, however, cannot fail to ultimately bring disastrous results to the corporation; a more conciliatory policy would be much more judicious at this particular time.

Safeguarding Employees Against Fire

In an editorial on page 887, we discussed the fire hazard in factories and pointed out steps to be taken in its control. This applied more particularly to the property hazard. The other side of the question, and the more important one, is the danger to the lives of employees.

We do not need to present figures to prove this loss of life. Anyone who reads our daily papers cannot fail to be impressed with the frequency with which deaths are recorded in factory fires. The Asch Building holocaust in New York City is still fresh in our minds.

But what is the principle to be followed in making a factory building safe from fire for the employees who work in it? To be saved from such a fire, one must get out of the fire zone; this means *sufficient exits to get all the occupants of a building to a place of safety in case of fire.*

This principle is basic and has no exception. It is as important in a fireproof building as in one of combustible materials; in a sprinkled building as in one unsprinkled; in a machine shop as in a factory using inflammable raw materials. The method of its application may differ, but the principle itself holds true.

H. F. J. Porter, of New York City, has declared this principle most emphatically, and has been a prime mover in developing building-code requirements for exits to make factory workers safe

from fire. These have been indorsed by the Citizens' Union, of New York City, with the hope that they will be incorporated in the new building code. They are:

Exits required irrespective of occupancy.

(1) For every floor area in each story (except the ground floor) at least one 44-in. wide stairway directly connected thereto.

(2) When such a floor area in any story exceeds 2500 sq.ft., at least one additional 44-in. stairway or a horizontal exit.

Additional requirements based upon occupancy. Every such floor area on each story to have either,

(a) One 44-in. stairway for every 24 occupants or fraction thereof, or

(b) A special 44-in. stairway for the exclusive use of every 200 occupants or fraction thereof in excess of those provided for by regular stair exits on the basis stated in (a) above, or

(c) A horizontal exit for every 200 occupants or fraction thereof in excess of those provided for by regular exits on the basis stated in (a) above.

These requirements recognize that elevators are unreliable as a means of emptying a burning building. They are unworthy of consideration as exits under most conditions. Therefore, in a multi-storied building, reliance must be placed upon the stairways, or horizontal exits, which will be referred to later.

The stairways to be adequate must be capable of emptying a building in three minutes. Any building that cannot be emptied in that length of time is considered unemptiable, and is a place which invites a holocaust. That stairways may be adequate, it is evident that we must know their capacity as a means of exit. Considerations of economy point to a width sufficient for two persons abreast.

Experiment has fixed this at 44 in. With this width two persons abreast cannot be wedged by a third person attempting to pass between them sidewise. The arch formed by three persons in such a position is unstable and gives way without the danger of jamming the stairway. The truth of this will be appreciated by anyone who takes the trouble to experiment.

Having established the width, it is next necessary to determine how many persons the stairway will accommodate at one time. This is evidently the number that is sufficient to fill the well from the top floor to the ground. Here experience has taught that 24 persons per story of ordinary height fill a stairway 44 in. wide. This factor again is easily demonstrated by anyone who chooses to consider the stairway in his office building or factory.

Thus, we have the minimum width of stairway fixed at 44 in. and the maximum number of persons per floor per stairway of that width as 24. This, as stated above, is based on the time element of emptying the building within three minutes.

It is obvious that in multi-storied buildings of large area, a number of stairways are required, and the expense of their construction and maintenance might be a heavy drain upon the earning capacity of the plant. This brings us to the third resort, the horizontal exit.

Mr. Porter has pointed out the ease with which the ground floor of any building can be emptied, and then argues that the same ease of emptying, if applied to floors above the first, would meet the requirements of the principle of safety laid down above. As a means of working this out, he has developed what is styled the "bisectional building." This consists of dividing every floor of a factory building into two sections, the dividing barrier being a fire wall with exits closed with fireproof doors.

If a fire originates in any place on any floor level, the employees in the danger zone can pass through this fire wall to the other side and be in a place of safety. The exit is horizontal. A minimum of time is required to go to safety under such conditions.

To provide the necessary element of safety, this fire wall, or barrier, is needed no matter how small the working area may be. In the case of very large floors, it may be advisable to have more than one, that is, divide the working space into more than two sections. This same advantage can be obtained by connecting two adjoining buildings by exits provided with fire-resisting doors.

These fire walls will afford practically permanent safety from flame, and in any event will hold back the fire long enough so that the occupants will have ample time to reach the streets by the ordinary means of descent. There should be no openings of any kind whatever through them, except the regular exits provided with fireproof, self-closing doors.

Comparing the requirements for stairways, as outlined above, and the requirements for horizontal exits, the latter will be undoubtedly the cheaper and may be expected to come into general use.

As previously pointed out, machine shops are usually situated under advantageous conditions, as regards the danger from fire, from surrounding buildings. This fact, however, is not sufficient to allow us to disregard or neglect a danger to life in our shops. The principle laid down, that to provide safety for the occupants of a building, there must be sufficient exits to get all to a place of safety in case of fire, holds for machine-shop buildings, as well as every other kind of factory building. It is earnestly to be hoped that managers will consider this problem whenever new shops are contemplated, and that investigations will be made of existing shops to see if they are emptiable. Unfortunately there are far too many unemptiable buildings in our country. We must put no faith in the theory of an unburnable building. There is no unburnable building any more than there is an unsinkable ship. The theory in regard to the latter has been exploded by the most awful sea tragedy of history. Let us sincerely hope that we will not wait for the visitation of a like calamity to explode the theory of the unburnable building. The safeguards against fire are: For property, automatic sprinklers; for life, sufficient exits.

New Publication

HOUSE WIRING. By Thomas W. Poppe. Paper; 103 pages, 4½x6½ in.; 74 illustrations in the text; indexed. The Norman W. Henley Publishing Co., New York. Price, 50c.

This little book is intended primarily for those desirous of obtaining a practical knowledge of the installation of electrical lighting systems. It is divided into seven chapters dealing with plans and layout, flexible metallic wiring systems, rigid conduit, flexible and rigid conduits in combination, wiring and switch diagrams, the grounding of metallic systems, knob and tube work. The book is written for the apprentice, helper, and electrician who is seeking a further knowledge of his trade. To such men it should be of value.

Personal

Frank L. Miller, formerly erecting engineer with the Southwark Foundry & Machine Co., Philadelphia, Penn., has accepted the position of chief engineer of the Parkersburg Machine Co., Parkersburg, W. Va.

F. E. Reed, founder of the F. E. Reed Co., recently absorbed by newly organized Reed-Prentice Co., of which he was a director and vice-president, has resigned, and in order to gain better health, has retired from all active work.

John R. Back, for many years a well known figure in the machine-tool industry, and superintendent of the F. E. Reed Co., Worcester, Mass., has resigned that position in the Reed-Prentice organization, which absorbed the Reed Co.

E. A. Ermold, who has been connected with the Electro-Dental Manufacturing Co., of Philadelphia, Penn., for the past five years, has taken a position as mechanical superintendent with the Wirt Electric Specialty Co., Germantown, Penn.

R. T. Wingo, previously connected with the engineering departments of the Cadillac and Hupp automobile companies, and an occasional contributor to these columns, has become associated with the Superior Machine & Engineering Co., Detroit, Mich.

J. P. Thompson, until recently general superintendent of the Cameron Steam Pump Co, New York, and previously connected with the Pond plant, in Plainfield, N. J., has become general superintendent of the recently organized Van Norman Machine Tool Co., Springfield, Mass.

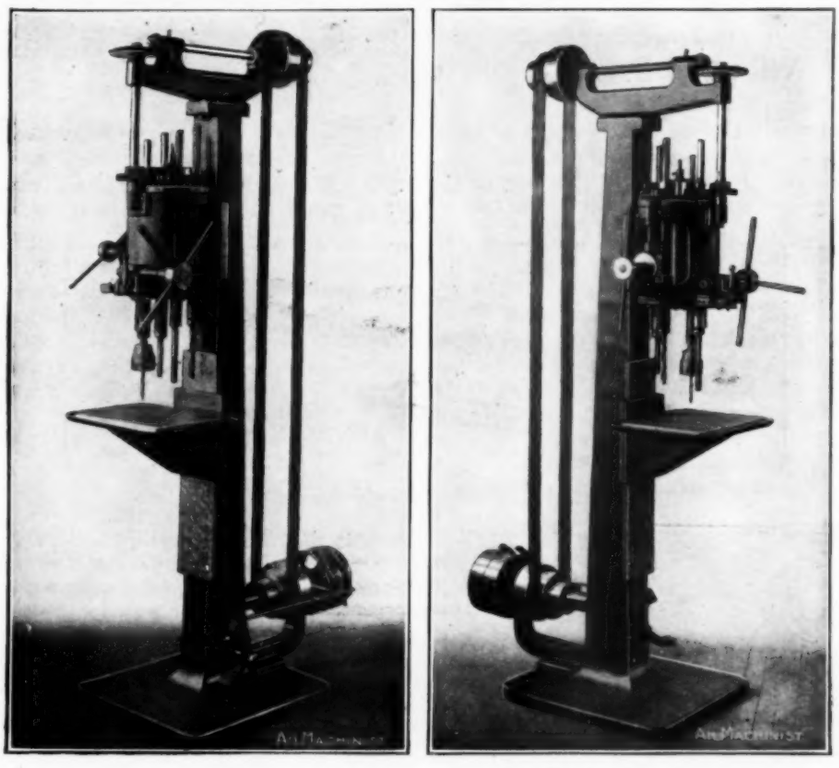
Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

A Four-Spindle Turret Drilling Machine

The halftones show a four-spindled turret drilling machine, built by the Turner Machine Co., Danbury, Conn., and Newark, N. J., and designated by the makers "a vertical turret boring and chucking machine."

The column of the machine is a rectangular box-shaped casting, on the top of which a bracket is bolted. This bracket carries the usual shaft, cone pulley and bevel pinion, engaging a bevel gear, which drives a vertical shaft. The lower end of this shaft is journaled in a bracket mounted on the upper part of the column. The duty of this shaft is to drive the various spindles of the machine. The driving of the spindles is through spur gears, mounted on the lower end of the vertical shaft and on the individual spindles.



A Four-spindle Turret Drilling Machine

The gears mounted on the spindles can be a size to drive the respective spindles at any desired speed within a fairly wide range. The turret is fitted in the inside of the cylinder bracket casting at the upper part of the column, and is provided with an indexing arrangement, so that any one of the four spindles can be instantly brought into, and locked in, operating position with its driving gear in engagement with the driving gear on the vertical shaft.

The indexing pin, located in front and at the lower part of the bracket casing which carries the turret, is thrown out of engagement with the turret by means of a small ball-ended lever, shown in the illustration, the turret can then be rotated in either direction by the double-ended lever, shown at the left of the machine.

When the next spindle is in operating position, the indexing pin is automatically released and locks the turret. The indexing-pin lever can, however, be held down until any one of the spindles is brought into operating position, or the turret can be revolved in one direction without the automatic lock operating.

Each spindle runs in a bearing in the upper part of the turret and at the bottom runs in a quill provided with a feed rack, which, when the spindle is in operating position, engages with a feed pinion on the end of the feed shaft. The driving gears are of steel with pointed teeth, so that while the machine is running, they slide readily into mesh with each other.

The spindles are individually counterbalanced by means of coil springs, which will lift them to the highest point or hold them at any desired point of their traverse, when they are not in operating position.

The machine is intended for manufacturing that class of work where more than one operation is performed on the work at any one setting, such as drilling stepped holes, reaming, counterboring, end milling, facing, tapping, etc.

The spindles are reamed Morse No. 2 taper, and will drive from ¼- to ¾-in. drills in cast iron. They have traverse of 7 in. The distance from the column to the operating spindle center is 8 inches.

The maximum distance from the operating spindle to the table is 28 in. The distance from the spindle to the base is 34 in. The height overall is 6 ft. 2 in. The floor space necessary is 24x25 in. The machine weighs 700 lb. All gears are provided with guards; these are not shown in the illustrations. The machine is also built in several other styles and sizes to suit various classes of work.

Micrometer with Friction Thimble

The purpose of the friction thimble with which this micrometer is equipped is to overcome the difference in the "feel" of the different parties measuring. In use the friction slips when more than a certain amount of pressure is applied and so prevents the measuring screw from turning further. This has an added advantage in that there is no danger of springing the frame.

Micrometer with Friction Thimble

The device consists chiefly of a coiled

flat spring of german silver. The inner end of this spring is attached to a washer, which is clamped to the end of the thimble by the shoulder on the central screw. The outer end slides around inside of the large bore in the outer revolving part, so arranged that in turning to the right the device slides over the spring, but in turning to the left the friction uncoils the spring, causing it to drive positively in this direction. It allows for a large and substantial screw for attaching; and also allows the knurled part to be reduced to a small diameter so as to provide a speeder as well.

With the friction thimble, the work is held in one hand and the tool in the other, the friction being worked by the thumb and forefinger of the hand holding the tool. Its use does not prohibit the use of the micrometer in the regular way. It extends only over a little more than half the full length, so that while it can be used when opened to its limit, still one may operate the screw without using this feature.

This device was recently applied to their polished pressed frame micrometer No. 26, by the J. T. Slocomb Co., Providence, R. I.

Bending Rolls with Plate Reinforced Top Roller

The halftone shows a machine, built by James Bennie & Sons, Glasgow, Scotland.

The capacity of the machine is for steel plates 10 ft. long by 1⅛ in. thick. The lower rollers are 11½in. diameter and are supported in the center of their length by a pair of friction rolls carried in a bracket resting on the foundation. The bending roller is 6½ in. in diameter, cambered to 6¾ in. in diameter in the center. The reinforcing roller is 16 in. in diameter. All the rollers are of forged steel.

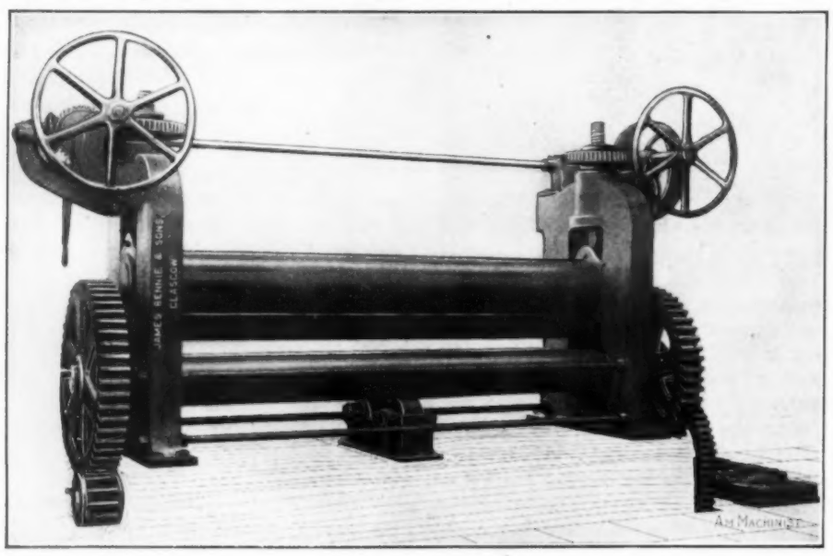


PLATE-BENDING ROLLS

Large spur wheels are keyed to the lower rollers and their pinions are mounted on an underground shaft, which extends the length of the machine to the gearing sole-plate, where spur gear to the motor (not shown in the illustration) complete the driving gear.

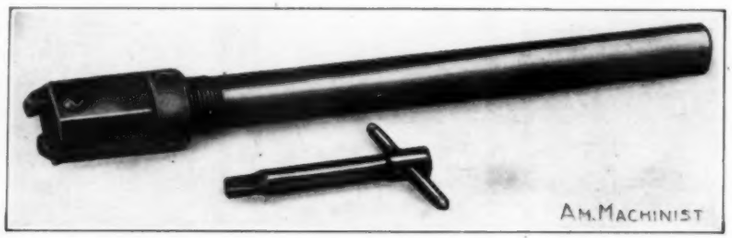
The elevating and lowering gear for the top rollers is arranged for operation by hand and power. By belt the top longitudinal shaft is driven continuously in one direction. Right- and left-hand friction clutches on this shaft give motion through bevel wheels and pinions to the wormwheels on the elevating screws, carrying the top-roller crossheads. This arrangement permits each end to be raised or lowered independently of the other.

The large handwheels, mounted on the worm spindles, are used for operating by hand when power is not available for the longitudinal shaft carrying the clutches. The total weight is 35,750 lb. The tool is not intended for bending complete circles.

Adjustable Boring Tool

This boring tool is designed to size holes either to standard sizes or to bore $^1/_{64}$ in. under, leaving a cut for a finishing reamer. The blades are put in dovetail slots and are set at an angle. The holder is so made as to clamp the blades with a squared-end wrench.

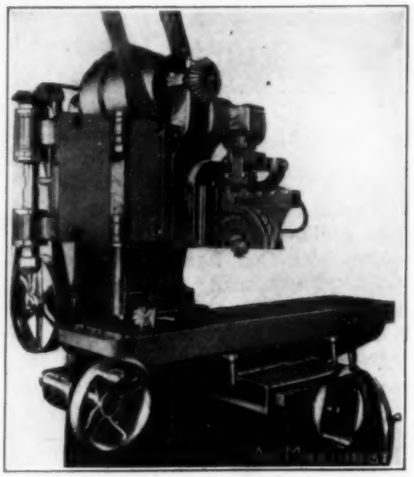
This tool-holder is a recent product of R. M. Clough, Tolland, Conn.



ADJUSTABLE BORING TOOL

A Die-Sinking Machine

The halftone shows a machine designed and built by the Welling-Northrup Co., Jackson, Mich., to work out drop-forging dies at one setting.



DIE-SINKING MACHINE

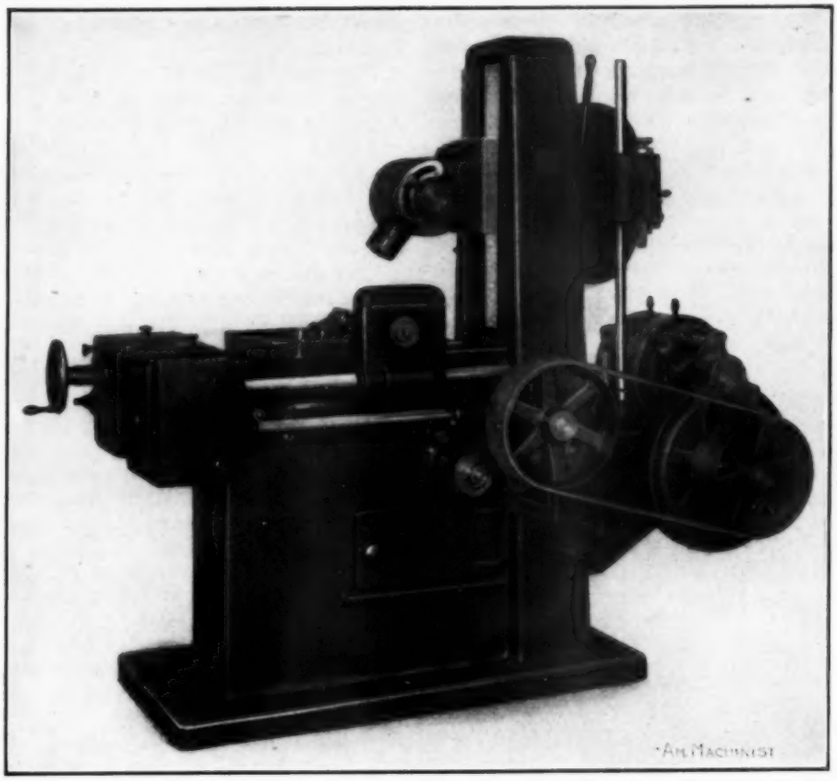
Besides the usual vertical spindle, which on this machine is carried in a bracket hinged to the main frame and shown swung out of the way, to the left, there is a device for "cherrying." This is shown in operating position in the halftone and consists of a rocking arm which carries at its end a cherry which, as it oscillates, is fed into the die block. Provision is made for raising the cherry on each noncutting stroke, and also for a limited amount of automatic side movement on the cherry without shifting the table.

An air pump supplies a jet of air on the cutting tools to keep the work free from chips. Six changes of speed are provided, giving a range sufficient for all requirements. The machine weighs about 4300 lb.

Motor-Driven Gear Cutter

The halftone shows a motor-driven automatic gear cutter built by the E. J. Flather Mfg. Co., Nashua, N. H.

The machine will cut both spur and bevel gears up to 40 in. in diameter by 9-in. face. The motor is a 2½-hp. Reliance constant speed and drives the machine by an endless belt. It is mounted on a sliding base, which permits the tightening of the driving belt.



A MOTOR-DRIVEN GEAR CUTTER

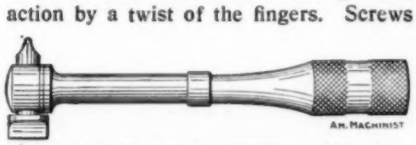
The indexing mechanism is entirely inclosed and is mounted in a detachable bracket.

The bevel gear-cutting attachment is shown bolted in place to the work spindle head.

Screwdriver for Inaccessible Screws

The purpose of this tool will be readily understood from the illustration.

Either end of the blade is brought into action by a twist of the fingers. Screws



SCREWDRIVER FOR INACCESSIBLE SCREWS

that cannot be reached with the regular straight screwdriver are readily handled with this type. Several styles of blades can be furnished.

The tool is a recent product of the Meriden Press & Drop Co., Meriden, Conn.

File and Tool Handles

The J. L. Osgood Tool Co., Buffalo, N. Y., has recently added several new types to its line of "indestructible" handles for tools.

The new screwdriver handle has grooves running transversely and horizontally, this giving a strong grip. It is made of hard wood; an inner tube is inserted both in the butt and in the front.

Tool Post Grinder

The portable electric tool-post grinder shown in Fig. 1 is a recent development of the American Electric Tool Co., West Newton, Mass.

The bearings are of hard bronze. The

FIG. 1. TOOL-POST GRINDER

one at the wheel end is extra large, tapered and split, and by means of 2 screws can be forced into the taper seat in the front head casting, thus taking up wear and eliminating side play. The tool carries a grinding wheel 6x3/8 in., which runs at a speed of 3500 r.p.m.

In Fig. 2 the grinder is shown grinding

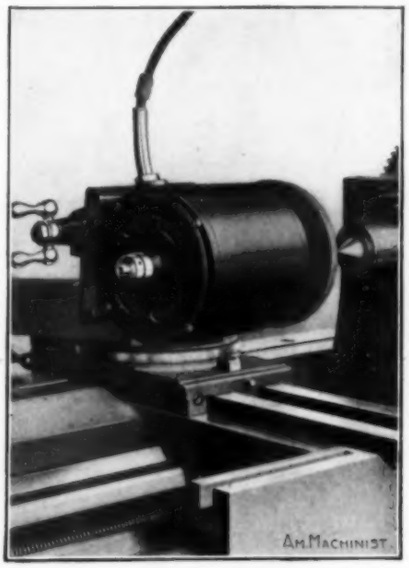


FIG. 2. GRINDING LATHE CENTER

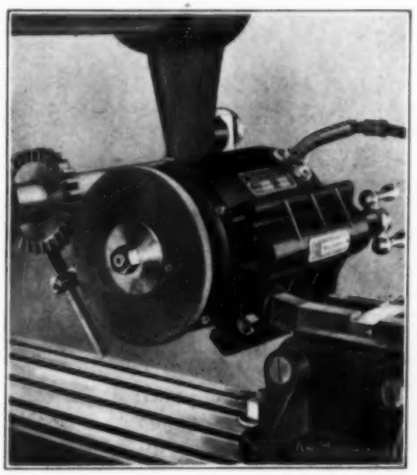


FIG. 3. APPLIED TO MILLER

a lathe center. It is readily applied to a lathe with either plain or compound rest. Another application of the tool is shown in Fig. 3 where a milling cutter is ground in place by use of the tool rest shown.

Rotary Riveting Machine

The halftone shows a rotary, high-speed riveting machine built by C. W. Meadowcroft, Sr., 4702 Large St., Frankford, Penn. The action of the machine can best be understood by referring to Fig. 2. The riveting punch *A* is backed up by the ball *B* held loosely in the member *C* so that it is free to move up or down. The member *D* is driven by the pulley shown in Fig. 1, and carries on its periphery a number of pockets which carry the balls *E*. As the member *D* turns, the balls are thrown outward by centrifugal force and when at their extreme outward position the ball *B* is in their path and they strike it a glancing

FIG. 1. A ROTARY RIVETING MACHINE

blow which it in turn imparts to the riveting punch *A*.

Thus, the riveting punch *A* receives as many blows per revolution of *D* as there are balls in the pocket in *D*. As all the balls including *B* are free to turn, the point of impact varies with each blow.

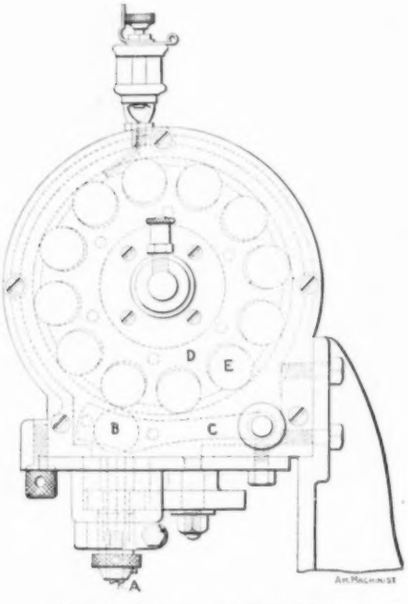
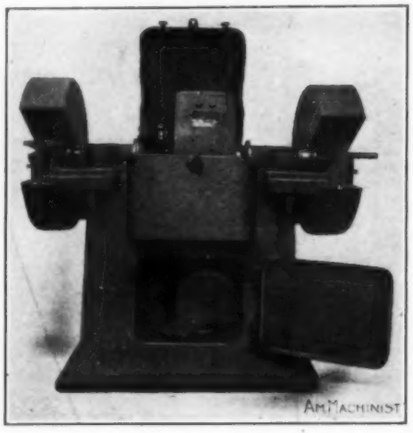


FIG. 2. DETAIL OF THE HEAD

The machine is built in various styles: As a bench machine with foot control, as a column machine with foot control, and as a bench or column machine with dial feed.

Motor-driven Dry Grinder

The motor-driven, direct-connected dry grinder was recently designed by the Springfield Manufacturing Co., Bridgeport, Conn.



MOTOR-DRIVEN DRY GRINDER

The motor is mounted on a substantial base and the whole inclosed in a dust-tight case, the upper half of which is mounted on hinges and is easily thrown back for inspection, adjustment and cleaning.

The machine takes two hoods, as shown, which are made so as to practically inclose the whole wheel with the exception of the part that must be left open in front. The hoods are made with an outer plate, which can be readily removed when it is desired to change the wheels. These hoods can also be connected with an exhaust system.

The controlling starting apparatus is all mounted on a special slab inside of the base and brought as close to the front as possible for convenience of operating. This machine is made in three sizes, suitable for wheels 12x2; 18x2, or 3; and 24x3, or 4 inches.

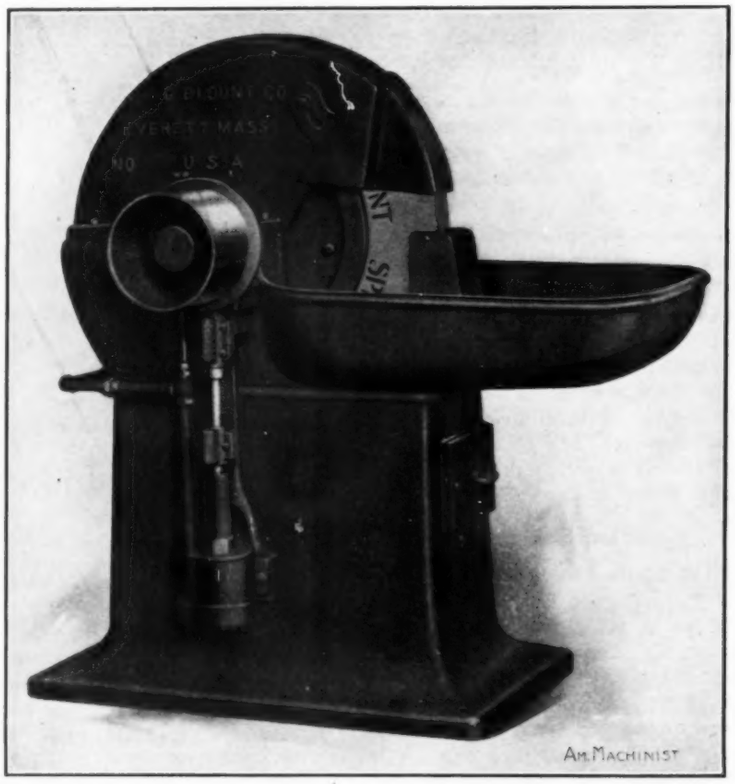
Wet Tool Grinder

This wet tool grinder is an improved design recently brought out by the J. G. Blount Co., Everett, Mass.

It is constructed along the same general lines as their previous machines but considerably heavier, carrying 30x3-in. wheels.

The bearings throughout are self-oiling, and, as shown, the machine is equipped with a vertical centrifugal pump.

The arbor bearings measure 9x2½ in., the pulley on the arbor is 9x5 in., and the height from the bottom of the pan to the top of the rest is 11½ in. The machine weighs complete 1675 pounds.



WET TOOL GRINDER

Bonus System in a Small Shop

By A. L. Haas

Payment by results, straight piecework, bonus premium, and combinations of various kinds are continually under discussion. Each system has its partisans and is subject to criticism of an adverse nature especially by the workmen.

A variant of the more elaborate systems in vogue recently came under observation. The works in question are small and under the direct personal guidance of the actual proprietor. The system works well in practice, fulfilling some of the results aimed at under more complicated systems. The work is the making of components for standard pneumatic tools; it is accurate and good-grade production; the mechanics employed are a picked class.

Each man is paid a standard rate of wages, in this instance 20c. per hour. Each piece of repetition work, finished, carries a money payment per each task fixed by the boss. The boy working the small turret lathe making refinished nuts and capscrews from the bar gets in addition to his weekly wage a bonus of 2c. for each 50 nuts finished. Small double-throw crankshafts for air drills are priced at 6c. each, this in addition to the hourly rate.

The foreman in this shop is also the inspector of the finished work, the workman getting credit for so many pieces at so much each. No special clerical labor is involved, the storekeeper entering each complete lot as passed in and the workman's name. The bonus is paid each week in addition to the standard rate for the hours worked. No abstruse mathematics are needed to calculate the bonus earned.

The bonus is figured upon a probable highest maximum of $2.50 per week each man, the usual addition varying from 60c. to $1.84. The prices set have never been cut. It is understood by the men that this additional payment is in the nature of a personal bonus. The bonus has been found sufficient to stimulate production, but not at the expense of accuracy, a very necessary point where limits are small. All work is to within 0.001 in. by micrometer, no limit gages being used.

The system was put into operation owing to the difficulty of straight piecework and has paid the firm well. The men are satisfied and the work turned out is of first-rate quality. Assembly as well as machining comes under the scheme. No finished tool is paid for unless it fulfills specified tests.

In conversation the question was put as to the case of the man who consistently fell below a certain bonus. The answer was a dumb indication of the door. That part of the system was automatic, and the simplest possible according to the boss.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND STATES

Keene & Kimball, proprietors of the garage on Burleigh St., Waterville, Maine, are erecting an addition. A machine shop and a nickel plating plant are being installed.

Frank S. Parsons, Maple St., Northampton, Mass., is building a 36x50 ft. brick and concrete extension to his garage.

Samuel Squires, Westfield, Mass., will award contracts for the erection of a garage, 90x157 ft., on the site of the Park Sq. stables.

B. Court Bentley, proprietor of the Westerly Garage on Main St., Westerly, R. I., will shortly erect a new building on the site of the old structure which was partially destroyed by fire. The building will be 30x100 ft. with a 20x40 ft. addition in the rear which will be used as a repair shop.

The Buick Garage, Hartford, Conn., was damaged by fire, June 1. Loss, $25,000; insurance, $7000.

The contract has been awarded for the construction of an addition to the factory of the Yale & Towne Co., Stamford, Conn. The estimated cost is $40,000. Noted May 30.

MIDDLE ATLANTIC STATES

The Albany Garage, 82 State St., Albany, N. Y., has awarded a contract for the construction of a four-story garage, 40x100 ft., of brick. The estimated cost is $65,000.

Fire caused a loss of $215,000 at the Upper Van Rensselaer plant, near Albany, N. Y., on June 4. The loss is divided as follows: Albany Foundry & Nickel Plate Co., $100,000; Standard Compound Co., foundry, $10,000.

The Crosby Co., manufacturer of bicycle parts, Buffalo, N. Y., is having plans prepared for the construction of a four-story addition to its metal stamping works on Pratt and Williams Sts. It will be of concrete and steel. The estimated cost, including equipment, is $150,000. William H. Crosby is president.

The locomotive works of the New York Central R.R., at Depew, N. Y., were damaged by fire, May 25. Loss, $1000.

A. S. Whitney, Gouverneur, N. Y., is building an addition to his garage on John St. It will be of cement block, 45x65 ft., one story high.

The Russell Foundry Machine Co., 51 Sixth St., Long Island City, N. Y., have had plans completed for the erection of a four-story foundry, 75x83 ft. The estimated cost is $25,000.

The General Vehicle Co., Long Island City, N. Y., has had plans completed for the construction of a new building at Review Ave. and Fox St. It will be one story, 50x100 ft., and will cost $8,000.

The establishment of the MacDougall & Potter Co., ironworkers, on the fourth floor at 606–612 West 55th St., New York, N. Y., was damaged by fire, June 4. Loss, $50,000.

The Newell Mfg. Co., manufacturer of brass specialties, Ogdensburg, N. Y., has had plans prepared for the construction of a new factory.

Bids are being received by the Rochester, Syracuse & Eastern R.R. Co., Syracuse, N. Y., for a car repair shop at Newark, N. Y. It will be one-story, 176x242 ft., of brick and steel.

The Crucible Steel Co. of America is building a new mixing room to replace the one recently destroyed at its plant at Syracuse, N. Y.

The A. F. Brown Co., manufacturer of power transmission, Elizabeth, N. J., has started the construction of a new addition, 90x160 ft., to its plant, to be used as a foundry.

D. S. Plum, manufacturer of machinery, Newark, N. J., will erect a three-story brick and concrete, manufacturing plant, 70x100 ft., at Dickerson and Norfolk Sts. The estimated cost is $25,000. Frederick A. Phelps, Union Bldg., is the architect.

The United States Steel Corporation will spend $8,000,000 in enlarging the Edgar Thomson Steel Plant, at Braddock, Penn. Twelve new furnaces will be erected.

The Cornopolis Garage Co., Cornopolis, Penn., contemplates enlarging its present building.

The Hooven Mercantile Co., Hazleton, Penn., has had plans prepared for the construction of a one-story garage, 28x32 ft.

Frank Hardart, 202 South Tenth St., Philadelphia, Penn., has awarded a contract for the construction of a garage, 66x125 ft. The cost is $40,000.

William Beehman, Philadelphia, Penn., has a permit for the erection of a 105x21 ft. brick garage on Conestoga St.

Samuel Davies, Reading, Penn., has been granted a permit for the construction of a one-story garage 40x50 ft., on Ninth St., between Bingham and Spruce Sts.

The Enterprise Fuel Co., Baltimore, Md., has awarded contracts for the erection of a fireproof garage at Oak and 24th Sts. It will be 28x60 ft.

The Croxton Motor Co., Washington, D. C., is contemplating the erection of an automobile factory. H. O. Davidson, architect, Cleveland, Ohio, is preparing plans for the construction of a concrete building with a steel frame, to cost $75,000.

SOUTHERN STATES

The Success Novelty Co., Richmond, Va., will remove its plant and install machinery to manufacture metal and machine specialties.

John L. Crockett, 101 Princeton Ave., Bluefield, W. Va., has awarded the contract for a garage 50x130 ft., to cost, $10,000.

The Wheeling Corrugating Co., Wheeling, W. Va., will erect a fireproof building, 100x200 ft.

The Oakdene Compass & Warehouse Co., Charleston, S. C., has awarded the contract for a plant 450x460 ft.

The garage of the Cowart Auto & Accessory Co., Atlanta, Ga., was damaged by fire at a loss of $6500.

The Harrold Banking & Savings Co., Macon, Ga. has awarded the contract for a two-story garage.

Frank Sloat will erect a garage at Savannah, Ga.

Otto M. Walter, 586½ North Gay St., Balti-

more, Md., is considering erecting an umbrella factory at Tampa, Fla.

The Central Iron & Foundry Co., Birmingham, Ala., will rebuild its furnace and also construct a new one. Estimated cost, $200,000.

The Birmingham Metal Product Co., Birmingham, Ala., will erect a plant for the manufacture of spiral culverts, etc.

The Siemund-Wenzel Electric Welding Co., 512 Colorado Bldg., Washington, D. C., will establish an electric-welding plant at New Orleans, La.

MIDDLE WEST

The Akron Rubber Machine & Mould Co., Akron, Ohio, has awarded the contract for a two-story brick and steel factory and office building. Noted May 16.

The Automatic Gas Safety Valve Co., Clyde, Ohio, has been organized with $10,000 capital and will equip factory to manufacture a new safety gas valve.

A garage will be built by E. R. Motch, 1578 East 115th St., Cleveland, Ohio.

The Variety Iron Works Co., Cleveland, Ohio, bridge and structural iron workers, will build a new branch plant in the south.

The Ferro Machine Foundry Co., 6811 Hubbard Ave., Cleveland, Ohio, is erecting a $15,000 addition to its plant.

The Globe Automatic Sprinkler Co., Cincinnati, Ohio, will expend $50,000 for new machinery and equipment for its new factory on Reading Road. A. B. Gould is the pres.

The Automatic Machine Mfg. Co., Cincinnati, Ohio, manufacturer of automatic newspaper vending machines, has leased a plant at Dempsey St., and will install equipment. John A. Rule, 1306 First National Bank Bldg., is the vice-pres.

The Cincinnati Gear Co., Cincinnati, Ohio, is having plans prepared for a two-story factory building on Reading Road. Philip Fosdick is the president, Murdock Bldg.

The plant of the Stewart Iron Works, Cincinnati, Ohio, manufacturer of iron fences, etc., was destroyed by fire on June 1st, with a loss of $100,000. The plant will be rebuilt at once to double its capacity. R. C. Stewart is the president.

The fourth floor of the Poland Bldg., 118 West Second St., Cincinnati, Ohio, occupied by the Harker Fire Extinguisher Co., was damaged by fire June 1. Loss, $5000.

The Buckeye Steel Castings Co., Columbus, Ohio, is in the market for considerable foundry equipment including several traveling cranes ranging from 5 to 40 tons capacity.

Fire recently destroyed the shops of The Hartman & Franz Co., Dayton, Ohio, manufacturers of tinners' supplies.

The Lima Locomotive & Machine Co., is having plans prepared for extensive additions to its plant at Lima, Ohio, which will involve the purchase of new machinery and equipment.

The garage of F. S. Rathwell, Lorain, Ohio, was destroyed by fire, May 31. Loss, $10,000, partly covered by insurance.

The works of the Lorain Auto Co., Lorain, Ohio, were damaged by fire, May 30. Loss about, $10,000.

Thomas & Armstrong, London, Ohio, manufacfacturers of galvanized iron products will erect a two-story building.

L. R. Wallace, Mt. Victory, Ohio, is constructing a cement block garage.

The Victor Safe & Lock Co. is having plans prepared for a two-story 100x300 ft. addition to its plant at Norwood, Ohio. Thomas S. Spivey is the president.

The Sandusky Auto Parts Co., Sandusky, Ohio will erect a two-story addition to its factory. R. D. Mitchell is the secretary.

The contract has been let by The Johnston Mfg. Co., Urbana, Ohio, manufacturer of oil cans and sheet metal goods, for a $12,000 addition to its factory. New equipment will be required.

The Mais Motor Truck Co., Indianapolis, Ind., has begun the construction of an addition to its present factory to contain 20,000 sq. ft. of space.

The Nessom Motors Co., Indianapolis, Ind., recently incorporated, will soon ask for bids for the erection of a large factory for the manufacture of autos, engines, etc. F. B. Brown is the president.

Equipment will be required for the manufacture of automobile steering gears, by the Ross Gear & Tool Co., Lafayette, Ind., which recently awarded a contract for its new factory.

Fire recently destroyed the plant of the Lion Motor Co., Adrian, Mich.

The Detroit United Ry. Co., Detroit, Mich., is erecting the first of four new buildings on Woodward Ave. The building will be used as a paint shop for the painting of the street cars.

The Michigan Pattern Works, Detroit, Mich., is erecting a new shop on Jefferson Ave.

The Detroit Insulated Wire Co., Detroit, Mich. is erecting a new factory at Wesson and Albert Aves.

The Gemmer Mfg. Co., Detroit, Mich., manufacturer of auto parts and steering gears, is building an addition to its forge shop on Stanton Ave. Noted April 25.

The Standard Brass Works, Detroit, Mich., manufacturers of brass goods and auto parts, are erecting a new factory on Wight St. Cost, $25,000.

The Chevrolet Motor Car Co., Detroit, Mich., will erect a building at its new plant on Woodward Ave. Estimated cost, $400,000.

B. Siegel, Detroit, Mich., will erect a large automobile building at Fort and Twelfth Sts., and install a repair shop.

The Cadillac Motor Car Co., Detroit, Mich., will erect a one-story brick shop 70x120 ft. at Amsterdam and Cass Aves. Estimated cost, $4,000. Noted May 22.

The Vinton Co., Grosse Pointe, Mich., will erect a two-story garage 25x38 ft.

The Dearborn Engraving Co., 631 Federal Bldg., Chicago, Ill., has had plans prepared and will soon receive bids for the construction of a two-story factory, 66x300 ft., in Holland, Mich. Estimated cost, $70,000.

The Mica Fireless Cooker Co., Saginaw, Mich., contemplates removing its factory to Kalamazoo, Mich., where it will erect a new one.

The factory of the Wilson Saw Mfg. Co., Port Huron, Mich., was practically destroyed by fire, May 30. Loss, $100,000.

The Home Stove Works, Chicago, Ill., will erect a factory, consisting of pattern shop, storage building and foundry. Noted May 22.

A. W. Rowe will erect a one-story garage 24x100 ft., at 3937 West Washington Boulevard, Chicago, Ill.

Christopher Bros., Chicago, Ill., will erect a garage to cost $10,000.

G. H. Gottschalk, 69 West Washington St., Chicago, Ill., will erect a two-story garage and office building.

The Chicago Heights Boiler Works, Chicago Heights, Ill., will erect a brick and steel shop, 50x100 ft. New equipment will be needed.

Ira B. Cook, Evanston, Ill., will erect a garage on Dempster St.

The Geneva Foundry & Machine Co. will erect a one-story foundry to cost $8000 at Geneva, Ill.

The Forest City Machine Co., Rockford, Ill., owner of patents on lace and ribbon invoicers, has purchased the factory of Duey & Wolff; after making considerable increase in equipment, will continue the manufacturing as conducted by that firm.

Fairbanks, Morse & Co., Beloit, Wis., are preparing plans for the erection of an addition to its foundry. Noted Apr. 25.

The Milwaukee Electric Railway & Light Co., Milwaukee, Wis., is ready for bids on the work of constructing the repair and wash shop, 500x60 ft. The other building will be 60x90 ft. R. H. Pinkley is in charge.

The Timmer & Hein Mfg. Co., Waldo, Wis., will erect a factory to manufacture washing machines.

WEST OF THE MISSISSIPPI

The Herring Motor Car Co., Des Moines, Iowa, will erect a factory. The estimated cost is $50,000.

The Shorthill Steel & Iron Co., Marshalltown Iowa, has started work on its new plant at Perry, Iowa. Noted May 2.

J. M. Frink, Wellsville, Kan., is planning to erect a garage and repair shop.

A. E. Hawn, Corsica, S. D., has started work on the erection of the garage for Davis & Stolt, of that city.

The plant of the West Twenty Lead & Zinc Co., Fairview, Mo., was burned, May 31. Loss, $30,000, partly covered by insurance. A. F. Ryder is general manager.

The Rothbert Steel & Iron Co., Denver, Colo., recently incorporated with a capital of $5,000,000 will build a plant in Denver or Pueblo. The incorporators are: D. E. Rowe, H. L. Hamilton and R. H. Tatlow.

J. H. Gill, Montrose, Colo., will erect a commerical garage at Montrose.

WESTERN STATES

A. C. St. John, Chehalis, Wash., has purchased a site near the Bush Buildings, Chehalis, and will erect a two-story commercial garage and machine shop.

H. F. Vollmer, Los Angeles, Calif., will soon commence the erection of a commercial garage and repair plant at Seventeenth St. and Grand Ave., Los Angeles. The estimated cost is $22,000.

The Union Iron Works, San Francisco, Calif., will erect a two-story and basement, steel and concrete power-house, to cost $75,000. Charles P. Weeks, Mutual Bank Building, San Francisco, is the architect.

CANADA

W. G. Ross, Montreal, Que., is arranging with members of the New Jersey Car Co., and other New York capitalists for the incorporation of a large car manufacturing company, which will build a plant at Montreal.

The Acme Electric Appliance Co., Brantford, Ont., is having plans prepared for a new factory. The estimated cost is $20,000.

The Steel Castings Co., Hamilton, Ont., has had plans prepared for the construction of a plant at Hamilton, C. W. Sherman, 189 Cleveland Ave., Buffalo, N. Y., is manager.

The Canadian Shovel & Tool Co., Imperial St., Hamilton, Ont., is building an addition to its plant at a cost of about $15,000. New machinery will be installed.

The Ottawa Car Co., Ottawa, Ont., is contemplating the erection of a factory, covering about two acres. All kinds of railway cars and traction automobiles will be manufactured.

The Russell Motor Car Co., Toronto, Ont., will soon begin the construction of a four story addition to its plant. The estimated cost is $100,000.

The Prince Albert Foundry, Prince Albert, Sask., was destroyed by fire, June 2. Loss, $20.000.

V. DeMille, Calgary, Alta, Canada, is constructing a two story garage on Eleventh Ave The estimated cost is $30,000.

The Edinger Co., Strathcona, Alta., will soon begin the erection of a garage. The estimated cost is $24,000.

NEW INCORPORATIONS

METAL WORKING

The following companies have been incorporated to manufacture:

The McKay Typewriter Co., Boston, Mass.; typewriters. Capital, $50,000. G. F. McKay is president and C. B. Edgerly, Derry, N. H. is treasurer.

The National Envelope Sealing & Stamping Co., Boston, Mass.; stamping machines. Capital, $500,000. Incorporators, Montgomery Reed, David J. Donahue, and Horace B. Stanton, 60 State St., Boston.

The Quigley Furnace & Foundry Co., Springfield, Mass.; furnaces. Capital $400,000. M. A. Danner, Natick, Mass., is president and W. P. Everts, Boston, is treasurer.

The Worcester Springs Co., Worcester, Mass.; springs. Capital, $25,000. Charles B. Jackson is president and treasurer.

The Northern Motor Co., Albany, N. Y.; automobiles and accessories. Capital $25,000. Incorporators: R. D. Cannon, A. P. James, Albany, and J. S. McClellan, Utica, N. Y.

The Egner Machine Co., Buffalo, N. Y.; machinists. Capital $5,000. Incorporators: Gustave A. Egner, William F. Egner and Martha Egner, all of Buffalo.

The Manufacturers Service Co., Boro. Manhattan, N. Y.; machinery and supplies. Capital $10,000. Incorporators: Walter J. Minchan, Herbert Huntington and Daniel E. Meegan, all of Buffalo, N. Y.

The Economy Car Heating Equipment Co., Boro. Manhattan, N. Y.; car heating and railway appliances. Capital $150,000. Incorporators: R. Catlin, I. C. Ramsburg and F. L. Durk, Brooklyn.

The Robert Stock Auto Spring Wheel Co., Boro. Manhattan, N. Y.; auto spring wheels. Capital $300,000. Incorporators, R. Stock, Tuckahoe, N. Y., J. F. Bockelman and E. Bockelman, Yonkers, N. Y;

The Weitch Motor Mfg. Co., Boro. Manhattan, N. Y.; motors and machinery. Capital, $200,000. Incorporators, J. S. Harris, P. J. McIntosh, New York, N. Y., and C. H. Toy, Brooklyn, N. Y.

The American Carburition Co., Boro. Manhattan, N. Y.; carburetors. Capital, $5000. Incorporators, William H. Wooley, 2 Rector St., Albert G. Hubbell, 92 Fifth Ave., and James F. Bisselle, 505 West 147th St., New York, N. Y.

The John Fuller Engineering Co., Boro. Manhattan, N. Y.; machinists and tool makers. Capital, $200,000. Incorporators, John Fuller, 601 West 149th St., New York, N. Y., Arthur Lowy and Cleveland L. Frizelle.

The Bradley-Winkler Coupler Co., West New York, N. J.; manufacturing the Bradley Patent Coupler. Capital, $50,000. Incorporators, P. R. Bradley, G. Winkler and J. V. McNeill, Guttenberg, N. J.

The A. B. Mfg. Co., Poughkeepsie, N. Y., automobiles and supplies. Capital, $200,000. Incorporators, M. M. Kotzen, R. H. Raphael, New York, N. Y., and J. Lichtenstein, Boro. Bronx, N. Y .

The Newark Auto Truck Mfg. Co., 173 Frelinghaysen Ave., Newark, N. J.; auto trucks and motor vehicles. Capital, $500,000. Incorporators, L. W. Babbage, 776 Broad St., Newark, N. J., H. H. Poole and John T. Walsh.

The Advance Electric Co., 33 Somerset St., N. Plainfield, N. J.; electrical appliances. Capital, $10,000. Incorporators, R. W. Osland, Plainfield, N. J., Anna H. Wood and Charles H. Witt, Trenton, N. J.

The Manhattan Sheet Metal Works, 180 Myrtle Ave., Passaic, N. J., Capital, $25,000. Incorporators, Mary Lichtenberg and B. Lichtenberg, 70 Van Buren St., and Dora Schumar, 180 Myrtle Ave., Passaic.

The Old Timelock Co., Cincinnati, Ohio; all kinds of locks. Capital, $50,000. Incorporators, Albert A. Huesman, Thomas H. Keeley, W. E. Wagner and A. L. Meinicke.

The Automatic Gas Safety Valve Co., Clyde, Ohio; gas appliances. Capital, $10,000. Incorporators, I. L. Cleveland, A. T. Gerber, A. E. Culbert and J. W. Worst.

The National Engine & Mfg. Co., Youngstown, Ohio; engines and machinery. Capital, $25,000. Incorporators, W. J. Sheldon, C. F. McLaughlin, H. R. Greenlee and C. W. Osborne.

The Bronx Electric Co., Chicago, Ill.; metal articles. Capital, $2500. Incorporators, O. W. Hogtedt 612 Ashland Blk., Harry B. Miller and Charles Cattern.

The Auto Utilities Mfg. Co., Chicago, Ill.; automobile specialties. Capital, $10,000. Incorporators, John F. Decker, Arthur Lewald, 1109 Tacoma Bldg., Chicago, and Belle Bellew.

The Ohio Motor Car Distributing Co. of Ill., Chicago, Ill.; motors, automobiles and accessories. Capital, $5000. Incorporators, Joseph Slottow, 30 North LaSalle St., Samuel C. Wood and Fred C. Churchill.

The Chicago Heating Appliance Co., Chicago, Ill. heating apparatus. Capital, $200,000. Incorporators, Drury F. Livesay, Fred W. Loreze and Maurice J. Golan.

The Cotta Gear Co., Rockford, Ill.; automobile parts and light machinery. Capital, $100,000. Incorporators, P. A. Peterson, Charles E. Cotta and Levin Faust.

General Manufacturing

NEW ENGLAND STATES

The Orono Pulp & Paper Co., Orono, Maine, will erect an addition to its plant, 60x100 ft. Estimated cost, $20,000.

The F. M. Hoyt Shoe Co., East Manchester, N. H., has received a permit to build an extensive addition of four stories to its main factory. Estimated cost, $20,000.

C. R. Crosby is building an 80,000-bushel grain elevator at Brattleboro, Vt., to cost $50,000.

The Missisquoi Paper & Pulp Co., Shelton, Vt., will erect a plant estimated to cost $200,000.

The Simonds File Co., Fitchburg, Mass., will erect a one-story concrete and brick addition to cost $7500.

Fire in the factory of the Williams & Winn Co., manufacturer of horn and celluloid, Leominster, Mass., caused a loss of $1500, on June 3.

The Appleton Co., Jackson St., Lowell, Mass., will receive bids for the construction of a new five-story cotton mill, 48x97 ft., to cost $80,000.

J. S. Barnet & Sons, Inc., manufacturers of leather, Lynn, Mass., have awarded contracts for a three-story brick and concrete factory, on Boston St. Estimated cost, $40,000.

The plant of the United Cork & Seal Co., Millis, Mass., was destroyed by an explosion of a gasoline engine, causing a loss of $75,000.

The Stansfield Felting Co., Oxford, Mass., is considering plans for the construction of a new factory. Noted May 23.

The Priscilla Woolen Mills, at Spencer, Mass., has been sold to David Bigwood, of Caryville, Mass., who will increase the capacity and manufacture high grade woolen goods.

The Hartford Tubing Co., Hartford, Conn., will build a new four-story cement plant, 100x300 ft. at Springfield, Mass.

The United States Finishing Co., silver platers, Providence, R. I., has awarded the contract for the construction of a new one-story addition, 100x167 ft.

The Cutter Mills Co., Warren, R. I., will improve and enlarge its plant. R. P. Walker is secretary.

Frederick M. Perry, of the Waterbury Steam Carpet Cleaning Co., Waterbury, Conn., has purchased property on South Main St., and plans to erect a brick building on the site.

MIDDLE ATLANTIC

The contract has been awarded for the construction of a new canning factory building having 80,000 sq. ft. of floor space for the Burt Olney Canning Co., Albion, N. Y. The building will be of brick and granite. Joseph C. Oberlies, Rochester N. Y., is architect. The estimated cost is $200,000.

The building at 10 and 12 Vandewater St., Brooklyn, N. Y., was destroyed by fire, June 3, at a loss of $100,000. The building was occupied by Lewis Roberts, manufacturer of printers' inks; Doorler's bindery, the Facsimile Letter Co. and the Lenz Photo Co.

The factories of the Allen Cigar Co. and the Underwood Typewriter Co., at Buffalo, N. Y., were damaged by fire, June 1, Loss, $18,000.

The Modern Laundry, Niagara and Virginia Sts., Buffalo, N. Y., was destroyed by fire, May 30. Loss, about $50,000.

The Fedders Co., Buffalo, N. Y., manufacturer of radiators for automobiles, has commenced work on the construction of an addition to its power plant at Tonawanda St. and West Ave.

The contract has been awarded for four factory buildings, 154x200 ft., 100x280 ft., and two buildings, 50x66 ft., for the Thatcher Mfg. Co., manufacturer of dairy supplies, Elmira, N. Y. The plant will be equipped for the manufacture of milk bottles and caps. Noted May 9.

The iron works of the McDougal Potter Co. and the factory of the Manhattan Chocolate Co., 606-612 West 55th St., New York, N.Y. were damaged by fire, June 4. Loss, $50,000.

The establishments of Neidlinger Bros., manufacturers of drug supplies and chemicals, and Armstrong & Co., cork manufacturers, 79 Murray St., New York, N. Y. were damaged by fire, June 3. Loss, $10,000.

The shirt factory of I. Gitenstein, 12 White St., New York, N. Y. was destroyed by fire, June 3.

The Western New York & Pennsylvania Traction Co. is receiving bids for the construction of a new power plant at Olean, N. Y. It will be 160x170 ft. and will cost $250,000.

The Defender Dry Plate Co., Rochester, N. Y., is taking bids for the construction of a new factory, one story high, 100x450 ft., of brick. James Tyler, Rochester, is the architect.

The contract has been awarded for the erection of a factory building, 110x160 ft., for the Welch Grape Juice Co., Westfield, N. Y. The building will be of reinforced concrete.

The plant of the Hardman Rubber Co., Belleville, N. J., was damaged by fire, June 1. Loss, $150,000.

The Pequanoc Rubber Co., Butler, N. J., has awarded a contract for the construction of a new factory. It will be three stories high, 43x50 ft., and will cost $14,000.

The Domestic Laundry, Third St. and Taylor Ave., Camden, N. J., was damaged by fire, June 1. Loss, $35,000, covered by insurance. Frank S. Rodan is president.

Four buildings at the plant of the Whitney Glass Co. ,Glassboro ,N. J., were destroyed by fire, June 5, Loss, $150,000.

J. Chein & Co., manufacturers of toys, 310 Passaic Ave., Newark, N. J., has awarded a contract for the erection of an addition to its plant. It will be of brick, three stories high and will cost $12,000.

The Allen Printing Co., 713 Linden St., Allentown, Penn., are about to erect a new building 40x60 ft., and will equip it with machinery. George A. Christ, 713 Linden St., is secretary.

The oil plant of the De Bergh Oil Co., Bethlehem, Penn., was destroyed by fire May 29. Loss, $6000

The Wahentah Silk Co., Catasauqua, Penn., will erect a one-story addition 60x128 ft., to its mills. The estimated cost is $75,000.

The Triumph Embroidery Co., Columbus, Penn. has purchased property adjoining its plant on which to erect a new factory. It will be 40x50 ft., three stories high, of brick.

The plant of the New Castle Box Co. at Mahoningtown, Penn., was destroyed by fire, May 22. Loss, $50,000.

The West Branch Novelty Works, Milton, Penn. have awarded the contract for the erection of a three story brick addiition.

Wyss Thalman, Wabash Bldg., Pittsburgh, Penn., has completed plans for a $120,000 ice plant for the Iron City Ice Co., to be erected on Bedford Ave.

The mixing house of M. B. Suydam Co., paint manufacturers, Sixty-first St., Pittsburgh, Penn., was destroyed by fire May 27. Loss, $3000.

S. Liebovitz & Sons, manufacturers of shirts, Pottstown, Penn., has awarded a contract for the construction of a new factory at Beach and Evans St. It will be of brick, three stories high, 90x127 ft. Noted May 23.

The oil plant of the Berg Co., Ontario St. and the Delaware River, Philadelphia, Penn., was damaged by fire, June 3. Loss, $8000.

The factory of John Knoell & Sons, manufacturers of furniture at 1524 North Hancock St., Philadelphia, Penn., was damaged by fire, May 31. Loss, $12,000

The asphalt plant of the F. E. Schneider Paving Co., Baltimore, Md., was burned June 1. Loss, $50,000.

The contract has been awarded by the Baltimore Mfg. Co., manufacturer of yeast, Monument and Buren Sts., Baltimore, Md., for the construction of two three-story addition to its plant. The structure will be of fireproof brick and concrete construction. The estimated cost is $80,000. Noted May 16.

SOUTHERN STATES

The I. Du Pont de Nemours Powder Co., Wilmington, Del., will build branch powder worksa t City Point, Va.

The Petersburg Rim & Veneer Co., Petersburg, Va., was totally destroyed by fire, May 31. Loss $40,000. It will be rebuilt at once.

The Auburn Lumber Co., Auburn, W. Va., will rebuild its saw and planing mills recently damaged by fire.

The McMechen Preserving Co., Wheeling, W. Va., has let the contract for the erection of a pulp mill.

The Lillian Knitting Mill Co., Albemarle, N. C., will install a steam heating plant in addition to its factory, which is being constructed.

Fire destroyed the cooperage of the Interstate Cooperage Co., Belhaven, N. C., May 31. Loss $100,000.

R. J. Stough, is planning the erection of a cotton mill at Cornelius, N. C.

The Best Chair Co. will rebuild its plant recently destroyed by fire at High Point, N. C.

Snyder Bros. will enlarge their cannery at Bluffton, S. C.

The city will receive bids, June 12, for the erection of two buildings, one 53x32 ft., the other 53x50 ft., and installation of machinery for an abattoir at Columbia, S. C. John McNeal is the city engineer.

The cottonseed-oil mill of the Lancaster Cotton Oil Co., Lancaster, S. C., was damaged by fire at a loss of $3500.

The Simpsonville Cotton Mills, Simpsonville, S. C., will erect another new addition.

Frank Lanier will erect a $50,000 light and power plant at Americus, Ga.

Deere & Co., Moline, Ill., will erect a vehicle plant at Atlanta, Ga.

Bowdon, Ga., has plans prepared for erecting a $20,000 water works and lighting plant. Plans are at the office of the J. B. McCrary Co., Atlanta, Ga.

The city of Buford, Ga., has plans prepared for a $15,000 water-works and lighting plant.

The National Show Case Co., Columbus, Ga., will build an additional story to its plant.

The Montezuma Mfg. Co., Montezuma, Ga., will install cotton gin and hydraulic presses.

The Callaway Lumber & Mfg. Co., Milledgeville, Ga., will erect a blind, door and sash factory.

The Newborn Gin Co., Newborn, Ga., will construct a gin. J. W. Pitts is the president.

Kelly & Co., Valdosta, Ga., contemplates establishing a cigar factory.

The city of Vidalia, Ga., will expend $50,000 for installing a sewerage system, improving waterworks and lighting plant, etc.

J. M. Murphy will begin the erection of a large water purifying plant in Key West, Fla.

T. A. Winfield, Little River, Fla., will build a plant 50x80. ft. for canning citrus fruits.

John T. Hammond contemplates building an electric-light plant at New Smyrna, Fla.

The Sarasota Citrus Exchange will erect a packing plant, 60x90 ft., at Sarasota, Fla.

The St. Clair Land & Lumber Co., Birmingham, Ala., will erect a mill at Stewart, Ala.

The Wiley Candy Co., Atlanta, Ga., will erect a factory in Birmingham, Ala. John L. Parker is president.

The American Creosoting Co. will erect a $200,000 creosoting plant at Bogalusa, Ala. The head office is at 95 Liberty St., New York.

Straiton Bros., Greensboro, Ala., will rebuild their wood-working plant recently destroyed by fire.

The Madrid Cotton Oil Co., Madrid, Ala., will erect a cotton seed oil, corn meal and corn products mill. Noted May 22.

Fire destroyed the sulphuric acid plant of the Bigbee Fertilizer Works, Montgomery, Ala., May 30. Loss, $100,000.

The acid plant of the American Agricultural Chemical Co., Montgomery, Ala., was destroyed by fire, May 30. Loss, $100,000, covered by insurance.

The Mobile Gas Co., Mobile, Ala., has awarded the contract to erect a brick building, 63x105 ft, Estimated cost, $9500.

A. G. Thatcher, pres. of the Coosa Mfg. Co., Piedmont, Ala., and associates, will organize a company to build a $60,000 plant for mercerizing cotton yarns at Piedmont.

The Tuskegee Normal & Industrial Institute will erect a heating and lighting plant, also a power house 112x203 ft., at Tuskegee, Ala.

Walter G. Franz, Union Trust Bldg., Cincinnati, Ohio, is receiving bids on power and heating equipment for a large building to be erected at Tuskegee, Ala.

The Consolidated Lumber Co., Indianapolis, Ind., will construct a large saw and planing mill at Georgetown, Miss.

The Southern Lumber & Timber Co., Hillsdale, Miss., will increase its mill capacity. R. Batson is the president.

The Colonial Creosoting Co. will erect a creosoting plant at Bogalusa, La.

The M. L. Hudson Lumber Co. will build a plant to manufacture kitchen tables, boxes, etc., at Shreveport, La. Estimated cost, $15,000.

The Fulton Mfg. Co., Fulton, Ky., will remove its plant to Shreveport, La.

Arthur Pratt will build a drain-tile factory at Athens, Tenn.

A factory for the manufacture of cedar slabs for the production of pencils, will be equipped by Houston & Liggett, Columbia, Tenn.

The G. E. MacKenney Trunk Co., Chattanooga, Tenn., will enlarge its trunk factory.

The plant of the Duncan Furniture Co., Erwin, Tenn., was damaged by fire at a loss of $5000.

The cotton gin of the Memphis Cotton Oil Co. in New South Memphis, Tenn., was damaged at a loss of $4000.

The Caraway Mfg. Co., Nashville, Tenn., will erect a wood-working plant at a cost of $20,000.

Yates, Brown & Yates, Paris, Tenn., will erect a saw mill near Springville, Tenn. Otway Yates is active manager.

The Kentucky Public Service Co. contemplates erecting a new gas plant at Bowling Green, Ky.

The A. P. White Co., Cadiz, Ky., will erect a large flour mill.

The city of Cadiz, Ky., will install two electric light plants.

Albert Smith will erect an electric-light plant at Fullerton, Ky.

The East St. Louis Cotton Oil Co., St. Louis, Mo., will establish a mill at Hickman, Ky.

The Roberts Oil Co., Memphis, Tenn., will establish a mill at Hickman, Ky.

The Hickory Handle factory at Kuttawa, Ky., owned by Tinsley & Juiggins, was destroyed by five, June 1. Loss, $4000; insurance, $1500.

The Bradford Worsted Spinning Co., Louisville, Ky., will erect an addition to its factory. Charles B. Nordeman is in charge.

Maysville, Ky., is contemplating the erection of an abbatoir. R. M. Allen, Lexington, Ky., is in charge.

The Evans Chemical Works, Nicholasville, Ky., contemplates installing a second-hand air compressor, with a capacity of 60 cu.ft. per minute.

T. H. Callahan, Paducah, Ky., is planning the establishment of a shoe factory to be equipped some time during the summer.

MIDDLE WEST

The Union Printing Ink Mfg. Co., Akron, Ohio, has raised its capital to $35,000, and will buy new power plant equipment.

The Goodyear Tire & Rubber Co., Akron, Ohio, has plans for another building, 400x79 ft. Building No. 13 will be remodeled and two stories added.

The city of Cleveland, Ohio, will receive bids until June 22 for a complete refrigerating plant for the new West Side Market House. J. W. Springborn is the clerk.

The Pond Creek Coe Co., Cleveland, Ohio, will erect a power plant with a capacity of 1200 kw., which will later be enlarged.

The Geise Cigar Box Co., Clay and Melindy Sts., Cincinnati, Ohio, is having plans prepared for a three-story brick building 90x35 ft. Martin Fisher is the architect.

The Arnold Creamery Co., Cincinnati, Ohio, will erect a two-story factory 50x92 ft. Estimated cost, $13,000.

The R. F. Johnston Paint Co. has purchased a factory at 2975 Spring Grove Ave., Cincinnati, Ohio, and will remodel and equip it. R. F. Johnston is the president, 228 Main St.

The contracts have been let for the addition to the plant of the Wilburne Oil Co. in Covington, Ohio.

The Virginia & Carolina Chemical Co., St. Bernard, Ohio, will erect a $150,000 factory.

The factory of the Defiance Tick Mitten Co., Toledo, Ohio, manufacturer of cloth gloves and mittens, was damaged by fire June 2. Estimated loss, $25,000. Noted May 16.

The Consolidated Stone Co., Bedford, Ind., will install machinery at a cost of $10,000 in its new plant.

The plant of the Dugan Cut Stone Co., Bedford, Ind., will install additional machinery at a cost of $10,000. It was recently purchased by the Consolidated Stone Co.

The American Furniture Co., Batesville, Ind., will build a four-story addition, 88x56 ft., for which bids will be asked immediately. Martin Fisher is the architect.

The D. M. Sears Co., Fort Wayne, Ind., recently incorporated with a capital of $75,000, will construct and equip a building to preserve and can fruits, vegetables, etc. D. M. Sears is the president.

The Maple City Mfg. Co., Goshen, Ind., recently incorporated, is preparing to ask for bids for the erection, completion and equipment of a large factory for the manufacture of lawn swings, porch furniture, etc. Estimated cost, $60,000.

The Housier Mfg. Co., New Castle, Ind., will receive bids for the erection of a large factory building for the manufacture of cabinets.

Walker Bros., 29 Farmer St., Detroit, Mich., have awarded the contract for a one-story bakery. 79x83 ft. Cost, $15,000.

D. A. Stratton will erect a new turning factory at Houghton, Mich.

The Village Council of Rogers City, Mich., contemplates the installation of a water-works.

The George H. Clippert & Bros. Brick Co., Springwells, Mich., will construct a new brick making plant.

The Hygienic Ice Co., Chicago, Ill., will erect a two-story ice making plant, 213x110 ft., to cost $70,000.

The laundry of Sulzberger & Sons, at Loomis and West 51st Sts., Chicago, Ill., was destroyed by fire, May 30. Loss, $5000.

The U. S Brewing Co., Chicago, Ill., will build a one-story brick addition to its brewery at 698 North Sangamon St. W. Ganger is the architect.

The Commonwealth Edison Co., Chicago, Ill., purchased a 20 acre tract of land on the east side of the Calumet River and will build a large power plant.

The Northwestern Baking Co., Chicago, Ill., will erect a three story bakery.

The Chicago Rawhide Co. will build a four-story brick addition, 50x140 ft., to cost $34,000, at 1301 Elston Ave., Chicago, Ill.

The Cairo Light & Power Co., Cairo, Ill., has let the contracts for a $60,000 power-house. Machinery will soon be installed.

The Curtis Brick Co., Kankakee, Ill., will erect a boiler and engine room 54x108 ft., to cost $35,000.

The Rossville Canning Co., Rossville, Ill., will erect a two-story and basement factory, 50x100 ft. J. Rutter is manager.

Hess & Hopkins will erect a five-story tannery 64x150 ft., at Rockford, Ill.

The planing mill of the Johnson Creek Lumber Co., near Knowlton, Wis., was destroyed by fire, June 3. The loss is partly covered by insurance.

The planing mill of the Sindahl-Matheson Co., at Neenah, Wis., was burned, May 31. Loss, $10,000; insurance, $5000.

The Oakfield Light & Power Co., Oakfield, Wis., is receiving bids for a complete light and power plant.

The Diehl Novelty Co., 909 Michigan Ave., Sheboygan, Wis., is receiving bids for a two-story building, 30x100 ft.

Martin Plehn is receiving bids for a heating and ventilating system to be installed in the Milwaukee County School of Agriculture and Domestic Economy, Wauwatosa, Wis.

WEST OF THE MISSISSIPPI

The city of Alden, Iowa, is contemplating the installation of a municipal water-works system.

The citizens of Williamsburg, Kan., have voted bonds for $5000 for the construction of a municipal light and water plant.

The Omaha Furniture Co., Omaha, Neb., recently organized with a capital of $100,000, will build a factory at Ralston. It will have about 40,000 ft. of floor space. M. C. Powell is president.

The town of Ethan, S. D., is planning to install a municipal water-works system. The estimated cost is $7500.

The Burlington Lumber Co., Libby, Mont., is planning to improve its lumber plant.

The Excello Feed Milling Co., St. Joseph, Mo., has increased its capital from $75,000 to $100,000, and will enlarge and improve its plant. An alfalfa mill will be installed.

The St. Louis Paper Pulp Mfg. Co., St. Louis, Mo., recently incorporated, is contemplating the erection of a large paper mill in or near St. Louis. The incorporators are, Eugene Tittman, George F. Tittman and William F. Heidman.

The Sutherland-Pedigo-Farwell Shoe Co., St. Louis, Mo., recently incorporated, with a capital of $150,000, has secured a site at Laclede and Vandeventer Aves., and will erect a shoe factory. The buildings will occupy a space, 150x188 ft. The incorporators are: S. G. Sutherland, F. A. Farwell and F. H. Weber. The factory will turn out about 2,000 pairs of shoes daily.

H. C. Kauffman, St. Louis, Mo., will soon commence the erection of a large flour milling plant at Camas, Mont.

The National Lumber & Creosoting Co., Texarkana, Tex., has had plans prepared for a creosoting plant to be erected in Houston, Tex. The estimated cost is $150,000.

The Texas Power & Light Co., Waco, Tex., is planning to erect an electric light and power plant at Waco. The estimated cost is $800,000.

The Farmers' Mill & Elevator at Hydro, Okla., were destroyed by fire, May 29. Loss, $7000; insurance, $5200.

The city of Oak Creek, Colo., will soon hold an election for the installation of a municipal waterworks.

The Southern Cotton Protecting Assn., Oklahoma City, Okla., will erect a plant. The estimated cost is $50,000.

The town of Quinlan, Okla., is contemplating the installation of a water-works system. The estimated cost is $20,000.

The Rapid Transit Interurban Co., Tecumseh, Okla., is planning to erect several large electric light and power plants.

The Inca Ditch Co., Aztec, N. M., is planning to install a water-works system at Aztec.

WESTERN STATES

The contract has been awarded for the construction of extensions to the water-works in Salmon City, Idaho. The estimated cost is $24,000. A. C. Merritt is city engineer.

F. E. Arthur and W. E. Williams of the Douglas Light & Power Co., Douglas, Ariz., have purchased property and rights near Florence, Ariz., and will erect an electric power plant.

The Mesa Improvement Co., Mesa, Ariz., is having plans prepared for a complete new water system for the new town of Chandler, Ariz. The equipment will include a standpipe of 90,000 gal. capacity, two pumps, and a system of concrete mains. H. J. Chandler is president and manager.

W. F. Cain, Phoenix, Ariz., and W. F. Loesch, Los Angeles, Calif., are considering the erection of an ice and cold storage plant at Buckeye, Ariz.

The Arizona Land & Irrigation Co., with headquarters at Indianapolis, Ind., will soon issue bonds for $1,000,000 for the installation of an irrigation system in Lonesome Valley, north of Prescott, Ariz.

The Broadway Laundry Co., Seattle, Wash., is planning to erect a steam laundry plant at Eagle St. and First Ave., Seattle. Charles Haynes, Mehlhorn Bldg., Seattle, is the architect.

The plant of the Auburn Lumber Co. at Wynaco, Wash., was burned, May 17. Loss, $70,000.

The Brownsville Woolen Mills, Brownsville, Ore., were damaged by fire, May 30. Loss, $1500, covered by insurance.

The saw mill of the Star Milling Co., in Scoggin's Valley, six miles from Forest Grove, Ore., was burned May 22. Loss $8000.

The Knapp sawmill and the plant of the Long Lake Lumber Co., near Klamath Falls, Ore., was destroyed by fire, June 1. Loss, $75,000.

The World Keepfresh Co., which has plants at Salem and Hillsboro, will establish a plant at Sutherlin, Ore., to cost about $11,000. The company has a method of keeping fruits, vegetables meats, etc., fresh for an indefinite length of time. R. W. King and A. B. Kirk, Portland, Ore., are interested. The new factory will be a two-story concrete structure, 160x36.

The city of Pilot Rock, Ore., will soon hold a special election for the purpose of voting bonds for $12,000 for the installation of a municipal water system.

The city council of Alhambra, Calif., is planning the installation of a municipal water system. T. B. Downer is city engineer.

The Imperial Valley Mercantile Co., El Centro Calif., will soon erect a vegetable and fruit canning plant at El Centro. George H. Wolffin is manager.

The city of Long Beach, Calif., is contemplating the installation of a high pressure salt water fire-protection system to cost $120,000.

The Libby, McNeil & Libby Co., Chicago, Ill., has acquired eight acres of land at Sacramento, Calif., and will erect a large fruit canning plant, at a cost of $75,000. J. S. Morrow, San Francisco, is western manager.

The United Sugar Co. of California, San Francisco Calif., has acquired property at Alturas, Calif., and will erect a sugar plant to cost $750,000. Frank McArthur, C. A. Estes, and G. F. Bigley are interested.

The Independent Lumber Co., Watsonville, Calif., is constructing a planing mill on Lake Ave.

CANADA

Bids will soon be received by F. U. Germain, engineer, St. Genevieve de Bastican, Que., for the installation of a water works system. The estimated cost is $25,000.

The Farmers' Binder Twine Co., Brantford, Ont., is contemplating the reconstruction of its factory factory which was recently destroyed by fire.

The Fort William Coal Dock Co., Fort William, Ont., has awarded the contract for the construction of additions to its plant. Noted June 6.

The Carney Lumber Co., Owen Sound, Ont., is planning to rebuild its plant which was recently destroyed by fire, with a loss of about $150,000. Noted May 30.

The Parkhill Flour Mill, Parkhill, Ont., was destroyed by fire, June 3. Loss, $15,000; insurance, $7000.

The Renfrew Woolen Mills Co., Renfrew, Ont., is having plans prepared for a new three story factory, 42x80 ft. The estimated cost is $22,000. New machinery will be installed.

S. E. Whiting, manager of the Bassano Electric Power & Traction Co., Bassano, Alta., will receive bids until June 17 for two return tubular boilers one steam engine, one electrical generator and complete equipment.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The Modern Stone Co., New Haven, Conn.; artificial stone. Capital, $50,000. Incorporators, Philip Liva, Louis Falco and M. M. Bartholomen, all of New Haven.

The Specialty Knit Goods Mfg. Co., Brooklyn, N. Y.; knit goods. Capital, $10,000. Incorporators, J. V. Schavrien, 1515 51st St., Lillian Rein, 76 So. 2nd St., and Stanley Mayer, 557 8th St., Brooklyn.

The Cunning Shoe Co., Troy, N. Y.; shoes. Capital, $5000. Incorporators, Daniel Cunning, Sarah Cunning and Arthur A. Cunning, all of 115 3rd St., Troy.

The Standard Wood Treating Co., Boro. Manhattan, N. Y.; asbestos and products. Capital, $100,000. Incorporators, Frank C. Schmitz, 177 Woodruff Ave., Robert W. Gray, 409 Putnam Ave., and Parke L. Woodward, 1798 West 1st St., Brooklyn, N. Y.

The Nahon Co., Boro. Manhattan, N. Y.; furniture. Capital, $150,000. Incorporators, E. E. Nahon, H. J. Nahon, New York, N. Y., and W. H. Gay, Grand Rapids, Mich.

Nathan Schreiber & Bro., Inc., Boro. Manhattan, N. Y.; flowers and feathers. Capital, $100,000. Incorporators, A. Schreiber, A. Rosenheim and L. W. Seligman, New York, N. Y.

The John Ashley Hosiery Co., Hackettstown, N. J.; hosiery. Capital, $50,000. Incorporators, J. Ashley, J. P. Althouse and J. C. Ashley, Hackettstown, N. J.

The Unico Silk Mfg. Co., 200 Straight St., Paterson, N. J.; silk and other textiles. Capital, $25,000. Incorporators, H. Rosengold, 198 Harrison St., J. Schneider, 148 Governor St., and S. Ordinanz, 47 Arch St., Paterson.

The Robinson Cabinet Mfg. Co., Toledo, Ohio; bath cabinets. Capital, $25,000. Incorporators, Harry S. Robinson, Walter G. Kirkbride and Deane W. Parker.

The Illinois Composition Floor Co., Chicago, Ill.; composition floor materials. Capital, $2500. Incorporators, Samuel A. Cooper, William H. Yeagle and C. G. Hawkins.

The Galloway Glass Co., Chicago, Ill.; glass and glassware. Capital, $10,000. Incorporators, George H. Anderson, Lillie G. Anderson and Arthur B. Edwards.

The A. Raffman Stave Co., Chicago, Ill.; timber products. Capital, $20,000. Incorporators, Adolph Raffman, Sidney Adler and Alfred Beck.

The Chicago Ferromatic Tire Co., Chicago, Ill.; automobile specialties. Capital, $10,000. Incorporators, B. N. Carter, H. C. Fleming and E. J. Knapp.

The Burge Mfg. Co., Houston, Tex.; furniture. Capital, $20,000. Incorporators, R. A. Burge, C. H. Myers and C. D. Woodburn.

The Common Sense Pile Protector Co., Long Beach, Calif.; patent protector device for wooden piles. Capital, $200,000. Incorporators, A. L. Reynolds, George W. Brown and Charles C. Huck.

The Wickens Lumber Co., Ltd., Wallaceburg, Ont.; lumber and woodenware. Capital, $10,000. Incorporators, Andrew Wickens and others.

FOREIGN

Bids for the installation of a 25,000-gal. quadruple-effect, sea water distilling plant, with all its appurtenances, in connection with the central power plant at the naval station at Guantanamo, Cuba, will be received until 11 a.m., June 22, by the Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Trade Catalogs

Thomson Electric Welding Co., Lynn, Mass. Catalog. Electric welding machines. Illustrated, 72 pages, 6¼x9¼ in.

Northampton Emery Wheel Co., Leeds, Mass. Bulletins. Water tool grinders, surfacing machines. Illustrated.

American No-Slip Cement Co., 153 Milk street, Boston, Mass. Booklet. Palium pulley covering. Illustrated, 12 pages, 3½x5½ in.

Stow Manufacturing Co., Binghamton, N. Y. Catalog No. 13. Flexible shafts. portable drills, grinders, multi-speed electric motors, etc. Illustrated, 88 pages, 6x9 in.

Business Items

At a recent meeting of the stockholders of the Hale Motor & Machine Co., Detroit, Mich., steps were taken to change the name of the company to Advance Machine Co.

The Universal Machine Screw Co., Hartford, Conn., has recently opened a New York office at Broadway and Canal Sts., of which C. D. Schmidt will be in charge.

The Winnipeg branch of the H. W. Johns-Manville Co., owing to their fast-increasing business, has found it necessary to move into new quarters at 92 Arthur street. This is a six-story and basement building, 100 feet deep and 50 wide, and will be occupied throughout by the company's offices and storerooms. By reason of this move, a much larger and more complete stock of goods will be carried on hand than heretofore, and a larger force will be employed to look after the company's interests.

Forthcoming Meetings

American Railway Master Mechanics' Association Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburgh, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

SCREW-MACHINE HAND, automatic, experienced on Gridley and Acme machines. Must be first-class. Address Box 4, Norwich, Conn.

Indiana

SUPERINTENDENT, a high grade, or foreman for tool room in modern factory; must be competent teacher of men and thoroughly conversant with improved shop methods; give experience and references. Box 337, Am. Machinist.

SUPERINTENDENT for a department of our works devoted to the manufacture of very accurate small cast iron and steel gears; must be a high grade, high minded mechanic who is naturally qualified to train and hold his workmen and who is well informed on modern tools and shop practices; information as to experience, references and qualifications for such position will be treated confidentially; a good opportunity for the right man. Box 336, Am. Mach.

Kentucky

BENCH HANDS, milling machine, and assemblers accustomed to typewriter work; state experience and compensation expected; steady work. Address Universal Stenotype Co., Owensboro, Ky.

Massachusetts

DIE SINKER, first-class, experienced on small follow-up dies; 40c. to 50c. per hour, according to ability; steady work; Boston. Box 355, Am. Mach.

MACHINIST—A snappy, up-to-date, thoroughly first-class machine tool operator with experience on engine or pump work. This man must be familiar with the very latest wrinkles in rapid-production methods, and competent to "speed up" a shop that is already on a better than average speed footing. Duties will be those of speed boss and rate setter, and will require man to spend most of his time on machine tools. This is no snap job, and nothing but a hustler is wanted. Write a letter that will get you the job, addressing Box 427.

Michigan

FOREMAN, experienced, to take charge of lathe assembling floor. Box 424, Am. Machinist.

By a company located in the middle west, manufacturing hoisting and conveying machinery, a young man with knowledge of shop management and wage systems, also experience in machine shop. Give full details of experience, positions held, references, and salary acceptable to start. A permanent position in good locality is assured the right man. Box 422, Am. Machinist.

New Jersey

MACHINIST, first-class, wanted to keep automatic wire-forming machinery in repair, one with experience in that line preferred, steady position to competent man. Address, stating experience, Acme Staple Co., Ltd., 112 N. 9th St., Camden, N. J.

New York

OPERATORS—Automatic screw machine operators on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co., Rochester, N. Y.

TOOL AND DIE MAKERS—No labor troubles. Steady employment and good wages to first-class men. Apply to Superintendent, U. S. Light & Heating Co., Niagara Falls, N. Y.

Ohio

MECHANICAL DRAFTSMAN, first class, on special and automatic machinery; permanent position and good opportunity for advancement for the right man; state experience, age and salary expected; application considered confidential. Box 413, Am. Mach.

MACHINE TOOL SALESMAN, first class wanted for New England territory; permanent position for the right man; none but experienced salesman considered. Box 408, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

DESIGNER—Jig and tool, capable. Must be experienced on machine tool work. Permanent position. Box 430, American Machinist.

Pennsylvania

CHIEF DRAFTSMAN—Desire man with experience in machine-shop practice and familiar with gas-engine design. Box 386, Am. Machinist.

TOOL DESIGNERS, first-class, on jigs and fixtures; only men capable of designing and making the drawings need apply. Address "Employment Department," P. O. Box 911, Pittsburgh, Penn.

ADVERTISING MAN, opening for, with some knowledge of metal working machinery, and ability to conduct an aggressive campaign as well as to supervise the production of highest class printed matter. Fine chance to become part of a large, firmly established machine tool manufacturing company. Box 428, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TOOL DESIGNER, man with experience in designing and machinery Reply to "Employment," Box 911, Pittsburgh, Penn.

ACME AUTOMATIC SCREW MACHINE HANDS, Gridley automatic screw machine hands, tool makers and coppersmiths. Address P. O Box 911, Pittsburgh, Penn

Virginia

DRAFTSMAN, EXPERIENCED, on heavy bending rolls, punch and shear, and heavy machinery State experience and salary expected. Covington Machine Company, Covington, Va.

Wisconsin

ASSISTANT SUPERINTENDENT—We want a man capable of taking charge of the productive end of plant manufacturing small high class electrical motors and apparatus. Electrical experience not absolutely necessary, but must be practical mechanic, skilled in designing tools and able to handle men to advantage. State age and experience. Box 432, American Machinist.

MEN WANTED—Because of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works. For men above the average such positions offer splendid opportunities. In addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary. One-third of our present employes have been with the management of this company from eight to twenty-six years. Address: "Factory Manager." The Thomas B. Jeffery Company, Kenosha, Wisconsin.

Foreign

MACHINE TOOL SALESMAN for Austria. Capable of demonstrating efficiency of modern machine tools. Give details of past experience, state references, nationality, age, salary, etc., in applying to Box 423, Am. Machinist.

POSITIONS WANTED

Connecticut

DRAFTSMAN, designer, age 30, broad experience in automatic and labor-saving machinery, desires a responsible position. Box 435, Am. Mach.

Illinois

FOREMAN—Toolmaker with technical education and experience on special machinery, dies and fixtures for manufacturing light machinery, sheet metal stampings and farm implements. Can design. Box 416, Am. Machinist.

MECHANICAL ENGINEER, graduated, first class, with 10 years' combined shop and office experience on jig, tool and fixture design and general machinery, desires position. Box 417, Am. Mach.

DESIGNER—shop and engineering experience Adding Machine, tools, wire products, special machinery 38 Seven years' with concern that raised salary from $1,250 00 to $7,000 00 as superintendent Good manager, Box 443

Massachusetts

MECHANICAL ENGINEER, 34, married, three years' experience, elevator and steam engine work, seven on gasoline motors and automobiles. First-class draftsman, familiar with pattern, foundry and machine shop practice can handle men to advantage Wants position as superintendent, engineer or both; small plant preferred, location not important Address "I. C. M., Am. Machinist

Michigan

SUPERINTENDENT—Practical skilled mechanic, in the prime of life, will take position of superintendent or factory manager, twenty years' experience One that knows how. Reference Write me. "Confidential," Box 442, Am. Machinist

New Hampshire

DESIGNING DRAFTSMAN, experienced, mechanical and electrical design, jigs, dies, and fixtures, desires permanent, responsible position Box 436 American Machinist

New Jersey

FOREMAN, 30, practical mechanic and executive, ngines and electrical machinery, can install and understands Taylor system. Box 418, Am Machinist

GENERAL FOUNDRY FOREMAN, experienced on high grade machine tool, general jobbing, and gasoline engine castings Am now making the finest semi-steel machine tool castings in New England Age 39, married, strictly temperate, molding machine experience. Diploma in McGain's system of mixing iron by analysis, cupola practice, and semi-steel. Salary, $3000. Box 426, Am. Machinist.

MAN, 41, now employed as factory superintendent, chief of production and tool design in large motor truck company, desires change. Address Box 431, American Machinist.

DESIGNER, fully experienced in shop and office. Tool design for best efficiency. Special and automatic machinery, experimental machinery developed. Am inventor with a broad mind. Can take charge. Technical education, large capacity and quick worker. References. Box 440, Am. Mach.

ASSISTANT SUPERINTENDENT—Tool-maker 30 to 35 years of age, in factory located at Newark, N. J., manufacturing pliers, nippers, etc. Must be first-class mechanic and ambitious. State experience, where previously employed, position held, salary expected and whether married or single. Box 420, Am. Machinist.

SUPERINTENDENT, chief draftsman, wants change to broader fields where inventive ability and successful manufacturing methods are wanted. Tool designer, labor saving, automatic, special machinery. Thoroughly versed in modern shop practice, simple shop systems and low cost manufacturing. Large capacity, technical education, splendid record, excellent executive. Box 441 Amer. Machinist.

New York

MECHANICAL DRAFTSMAN wishes position. Box 388, Am. Machinist.

TOOLROOM FOREMAN—Expert on dies, designer with up-to-date ideas and A1 references wants to make a change. Box 419, Am. Machinist.

FOREMAN of screw machine departments wishes to make change, thoroughly understands automatic and hand screw, also Potter & Johnston, machines; can get best results, can handle men to advantage. Box 421, Am. Machinist.

SUPERINTENDENT—Technical graduate; ten years' experience in shop and drafting room. At present superintendent of small manufacturing concern. Wishes position as assistant to manager or superintendent in a large or growing organization. Ability, Box 425, Am. Machinist.

MECHANICAL ENGINEER—just completing installation of modern method of management, associated with leading authorities on the subject, desires a permanent connection with a reliable concern as Assistant Manager or Superintendent. Experienced in testing, research work and statistics. Strong disciplinarian Best references. State all details in first letter. Box 433,

DRAFTSMAN, with shop experience, desires permanent position. Box 434, Amer. Machinist.

FOREMAN—Designer, German, 40, wishes steady position on small interchangeable work; automatic machinery or clock work preferred. Anywhere to July 1. Box 439, Amer. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

GENERAL FOREMAN, trained at Ludw. Loewe & Co., Berlin (Germany) wants position. Preferred small automatic machinery or interchangeable work. Will go anywhere. Box 438, Amer. Machinist.

SUPERINTENDENT, 34; expert in manufacturing at low cost; extensive experience in equipping machine tools for making large variety of parts; successful in introducing simple and practical factory system with large concerns of highest reputation; can lay out plant with idea of taking care of continuous extensions; engaged but desires change, preferably with growing concern manufacturing specialties. Box 407, Am. Machinist.

Pennsylvania

MANUFACTURERS' AGENT, with good engineering experience covering Pennsylvania, invites correspondence from manufacturing concerns wishing to develop trade of new article. Box 437, American Machinist.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

Manufacturer wanted to make calculating machine, including tools and dies. Box 429, American Machinist.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

Experimental apparatus or anything needing extra good machine shop work and oversight can be economically built at my new laboratory and shop. A. H. Emery, Stamford, Conn. Works at Glenbrook, Conn.

For Sale, Foundry—Exceptional opportunity for firm requiring branch iron foundry in Chicago Centrally located in manufacturing district. Completely equipped for heavy or light work Convenient team track facilities. Also own adjacent vacant property suitable for factory. Owing to death of former owner will make attractive price. Address Lauren H. Knox, 138 N. La Salle St., Room 45, Chicago, Ill.

Jackson Boilers, Ltd., Queen Square, Leeds, the patent owners and sole manufacturers of the Jackson water boilers as used in mills, factories, workshops, hotels, cafés, restaurants, hospitals, and wherever boiling water is required at short notice for tea and coffee making—are open to dispose of their American patent and manufacturing rights. The Jackson boilers are a proved success in England and the colonies, and there is a great future for them in the States if energetically introduced. Communications from principals only will be entertained. Box 415, Am. Machinist.

Talks With Our Readers

By The Sales Manager

"Three illusions are common to nearly all men. Nearly every man thinks that he thoroughly understands human nature, that he can run the local newspaper better than the editor runs it, and that he can write advertising."

So delivers himself a prominent national advertiser—who is besides, we might add, a keen analyst of his fellow-kind, with some right notions on advertising in general.

"That he can write advertising!"

You all have heard and perhaps know some specimens of the fellow who thinks he could make Greeley, Dana, Pulitzer & Co. look like twenty-nine cents in the newspaper game (if he only wanted to)—and you know the other fellow, who believes he can read and interpret, without a miscue, all the motives, actions and secret thoughts of the folks next door.

But—the man who thinks he can write advertising if he only wanted to—he's a newer phenomenon. New, probably, because advertising in the right sense is itself more or less new.

Why is it so many people think they can write advertising, especially those who, able or expert in some other line, really haven't the least qualification or aptitude for the job?

Because advertising is thought of as authorship—as writing.

We're a nation of authors. Go past the newsstand for proof. Doctors, lawyers, merchants, thieves, professors and old ladies—write. If a financier or a second-story operator is laid up at home with the gout or laid out at home with a billy, he fills in the enforced leisure by writing a book—about something. Novel, poem, play, essay, book of travels, "true" story of somebody, "appreciation" or damnation, *something* about *something*. And everybody reads—reads—reads.

Thus, it is easy to account for such widespread belief—or conceit—in ability to write advertising, when advertising is looked on as "authorship."

But consider a moment—

These tons of cheap, hurriedly, ignorantly written novels, stories, plays, etc., that stack the newsstands—people are not really *influenced* by reading such. Such stuff is bought to fill in the time, exactly as a lot of it is written—because the writer didn't have anything else in particular to do.

Now, *advertising* that is *written* in this way, will be *read* in this way. It'll be a soporific (see Dictionary!), not stimulus to action.

But, let us whisper you this—

Real advertising is *only incidentally* writing. It is salesmanship that simply happens to be talking *per* the printed page—"happens to be," because it found a magnificently big opportunity to talk thus *through the eyes* of ten thousand humans at once instead of *through the ears* of the ten thousand in succession—if it could find 'em.

Of course, let us hasten to say, advertising has not shoved the real genus homo salesman out of his job, any more than the telephone has abolished letter writing; for, as the telephone simply does more swiftly and cheaply a myriad things the letter used to do, leaving the letter to confirm, to clinch the bargain, so with advertising and the salesman—who lands the prospect that the ad. fishes up, who closes the sale that the ad. begins, and who does some certain other things only a thinking man on two legs can do. One great advantage of advertising over the salesman system simon pure, outside of its superior economy, is that advertising *discovers possibilities of business* in places where the salesman never dreams of looking.

But we're talking just now about *writing* ads.—and the gist of it all, with which we end, is "these"—

AN AD., "as is one," can't be written by the fellow who hasn't in him the spark for firing others to action—feeling-action, thought-action—any more than the Odyssey could be written by the office boy. The real ad-man, ad-builder and ad-dreamer, instead of and far from being a mere pen-shover, is—75% of him at least—that vivid, imaginative, dynamic genius of this modern time—SALESMAN.

* * *

Only reliable products can be continuously advertised.

Tools in a Cream Separator Plant

By F. A. Stanley

The operations involved in the machining of separator frames include boring the bowl spindle and gear shaft bearings, facing and turning the bearing bosses, boring and facing the neck, milling a pad at the side for the upright arm and milling the bearing surfaces of the arm itself.

The jigs and fixtures for these processes are of unusual interest and like the cutting tools are constructed for producing accurate results.

In an earlier article dealing with the methods of the Iowa Dairy Separator Co., of Waterloo, Iowa, reference was made to two of the lines of separators manufactured by this firm, but the illustrations were confined principally to tools for handling one of these types only. The present article will deal specifically with methods employed for machining certain important members entering into the construction of the other type of separator.

The view in the testing department, Fig. 1, showing a number of this class of separators under the "running off" belts is presented as the first illustration in order to show the general form of the frame, the machining of which forms the basis of a major portion of this article.

The separators in this view, as will be noted, are shown without the upright arm which, when the machine is fully assembled, is attached to the planed pad on the side of the frame to carry the milk pan. This arm, like the frame which carries it, is machined with the aid of a number of interesting tools, also illustrated.

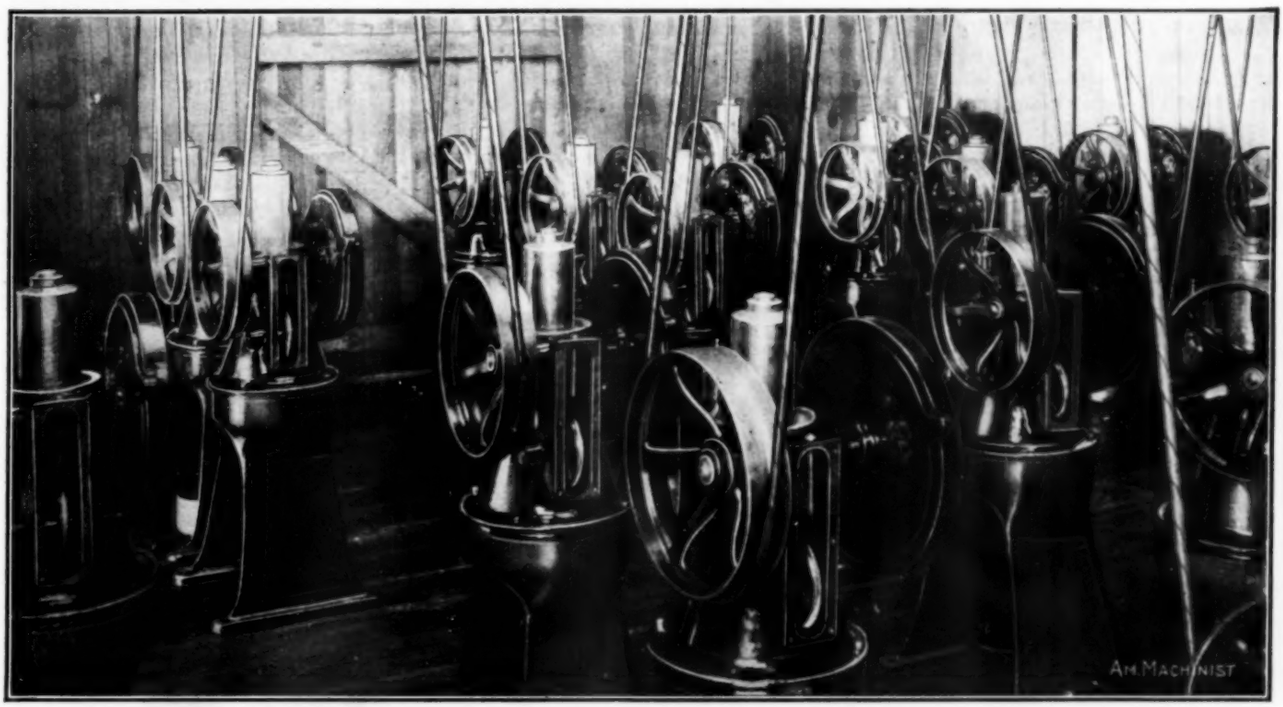


FIG. 1. A LOT OF CREAM SEPARATORS UNDER THE "RUNNING-OFF" BELTS BEFORE ATTACHING THE UPRIGHT ARMS

MACHINING THE FRAME

The first operation on the cone-shaped frame consists in facing the bottom true to facilitate later machining processes, and also to provide a suitable surface for resting upon the two-legged casting which forms the base of the whole separator. The facing is accomplished in a lathe and the frame is then ready for boring for the center bearing.

This frame carries the shafts, gearing and bowl spindle constituting the entire mechanism of the machine. The spindle is journaled at the lower end in a bronze bush which is fitted in a steel box tapered externally to fit a taper seat bored in the bottom of the cast-iron frame. This taper seat and the cylindrical opening through the upper part of the frame must be bored exactly in line with each other. This is accomplished with the tools in Figs. 2 and 3.

THE BORING JIG AND TOOLS

The general character of the jig will be seen from Fig. 2 which also shows clearly the form of the casting to be bored. The boring tools in Fig. 3 are arranged in the order in which they are used. The chuck on the shelf at *A* is a centering device which is utilized in locating the work in the jig before the clamps and screws are tightened.

The centering device positions the frame to be bored, so that the round neck of the frame will be concentric with the jig bushing and the bearing opening will be bored central with the whole frame. This device has a round body like a chuck, with three jaws which are hooked at the back to drop over the top of the work and provided at the front with projections which are turned taper on the outside as shown.

The conical surfaces on the jaws correspond in taper to the internal cone formed in the mouth of the sleeve *B* which is finished externally to fit the fixed guide bushing in the top of the jig, and also to fit the cylindrical opening bored in the chuck face.

The separator frame to be bored is slid into the jig with the centering device on the frame and with the three jaws in contact with the top of the casting. The bell-mouthed sleeve is slipped into the jig bushing and the work is then moved on its base until the sleeve enters the opening in the chuck face and at the same time passes down over the cone-shaped projections of the jaws. The work is then central and is secured in place by the screws and clamps shown in Fig. 2.

SEQUENCE OF OPERATIONS

The first cutting tool used is the boring bar and cutter *C*. This rough bores

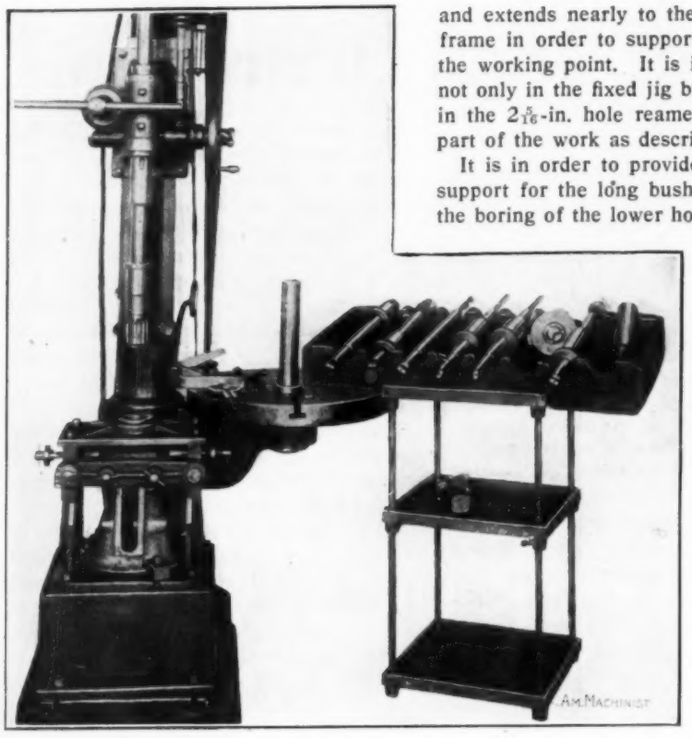


FIG. 2. BORING MACHINE WITH JIG AND TOOLS FOR SEPARATOR FRAME

and extends nearly to the bottom of the frame in order to support the drill near the working point. It is itself supported not only in the fixed jig bushing but also in the $2\frac{5}{16}$-in. hole reamed in the upper part of the work as described above.

It is in order to provide this complete support for the long bushing and assure the boring of the lower hole in alignment with the upper one, that the latter is bored and reamed true at the outset to $2\frac{5}{16}$ in., which is not the permanent diameter of the hole but merely a size given it temporarily to facilitate the operations that follow.

the upper opening in the frame to a diameter of $2\frac{9}{32}$ in., after which the reamer *D* is run down through to size the hole to $2\frac{5}{16}$ in. Both the cutter bar and reamer, like other tools in this set, carry their own cast-iron bushings which run, in the hardened-steel guide bushing fixed in the jig.

The next tool applied is the twist drill *E* which is supported in the long bushing *F* and which drills a $\frac{27}{32}$ in. hole in the bottom of the frame as the first step in forming the seat for the taper box which carries the lower end of the bowl spindle. The bushing for this drill is 15 in. long

FURTHER BORING AND REAMING

The twist drill is followed by the boring bar *G* which carries a flat cutter at the small end for boring the lower hole in the frame to a size suited to the small end of the taper reamer. A larger cutter in the body of the bar at the same time rebores the upper opening in the frame to within $\frac{1}{64}$ of its final size, which is to be $2\frac{3}{8}$ in. The boring bar is well supported at both ends, the pilot at the lower end having a keyway and carrying a bushing which revolves with the bar in a fixed guide bushing in the bottom of the jig.

This bar is followed in turn by a second bar *H* which is guided in the same manner and which enlarges the lower hole for half its depth to a size which leaves little material for the taper reamer to remove. The large cutter in this bar finishes the upper hole to within 0.005 in. of size and this amount is removed by the finishing reamer *I*. The taper reamer *J* is then used to finish the bearing seat at the bottom. The bushing for the latter reamer is very long and, like the drill and boring-bar bushings, is carried both in the fixed bushing in the jig and in the upper opening bored in the work.

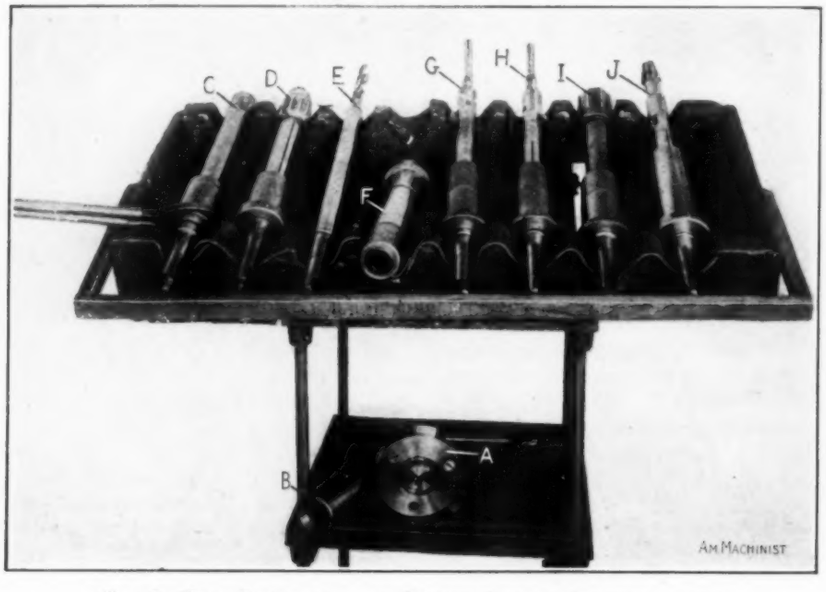


FIG. 3. TOOL EQUIPMENT FOR BORING CENTER BEARING IN THE SEPARATOR FRAMES

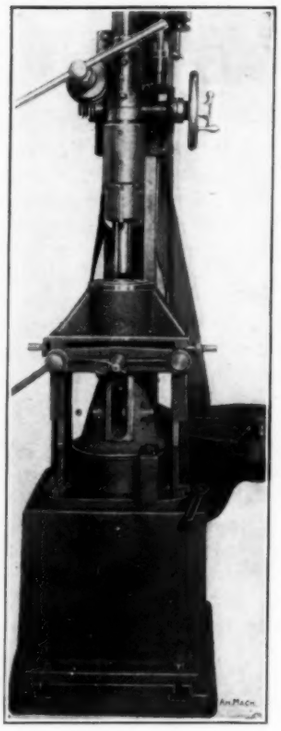


FIG. 4. ROUGH BORING UNDER DRILLER

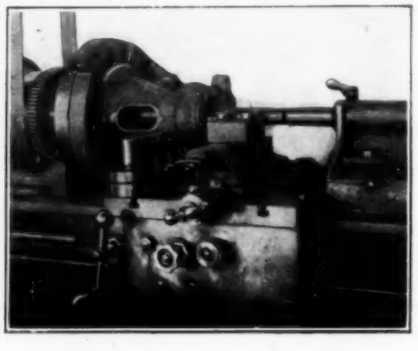


FIG. 5. FINISH BORING TOP OF FRAME IN THE LATHE

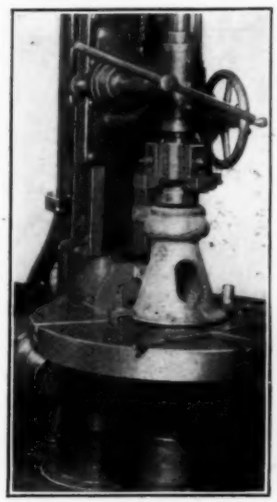


FIG. 6. FACING TOP OF SEPARATOR FRAME

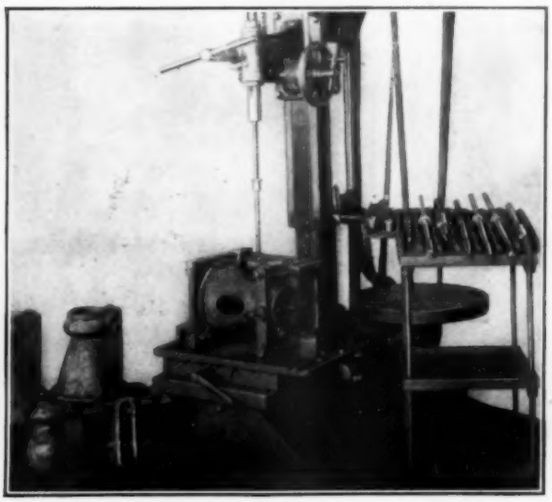


FIG. 7. CROSS BORING FRAME FOR GEAR CENTERS

MACHINING THE FRAME NECK

At the very top of the separator frame an enlarged opening is required which is bored out in the neck for a depth of about ¼ in. to form a seat for the base of the milk pan which surrounds and completely incloses the bowl. This seat must be perfectly concentric with the central openings previously bored in the frame and the operation is performed in the manner indicated in Figs. 4 and 5.

The roughing is accomplished with the work held in the jig, Fig. 4, and with a counterboring tool provided with inserted blades. The tool is piloted in the hole already bored in the frame and is further guided by the enlarged body behind the boring head, which fits the bushing in the jig. The frame is now placed on an arbor between centers as in Fig. 5 and a few thousandths bored out with a single-point tool, assuring perfect alignment with the center bearing.

FACING AND CROSS BORING

It should be noted in connection with Figs. 2 and 4, that the bases upon which the work and jigs stand are carefully tested at frequent intervals with tram and indicator and kept as nearly square as possible with the machine spindles. Similarly the tables of the drillers for other operations are kept true and are supported to prevent deflection under load, as in Figs. 6, 7, 8 and 9.

The first of these views represents the method of facing and finishing the top of the separator frame with a piloted tool carrying a set of independently adjustable cutters. Fig. 7 shows the equipment for boring the crosswise bearings in the frame to carry the short gear shafts which actuate the vertical bowl spindle. These bearings must be an exact distance from the center bearing for the spindle and accurately positioned in other respects.

The method of holding the work in the jig is plainly shown. Bushings are provided in the top and bottom of the jig and the boring bars which follow the twist drills are supported in these at opposite sides of the work. The full set of drills, bars, bushings and reamers will be noticed upon the stand at the right of the machine.

FINISHING BOSSES

The outer ends of the bearing bosses are faced off with the work held on an upright post as shown in Fig. 8. The lug at the top of the frame is turned to a certain diameter to receive the hub of the gear case; this work is done with

FIG. 8. FACING THE OUTER ENDS OF BEARING BOSSES ON SIDE OF FRAME

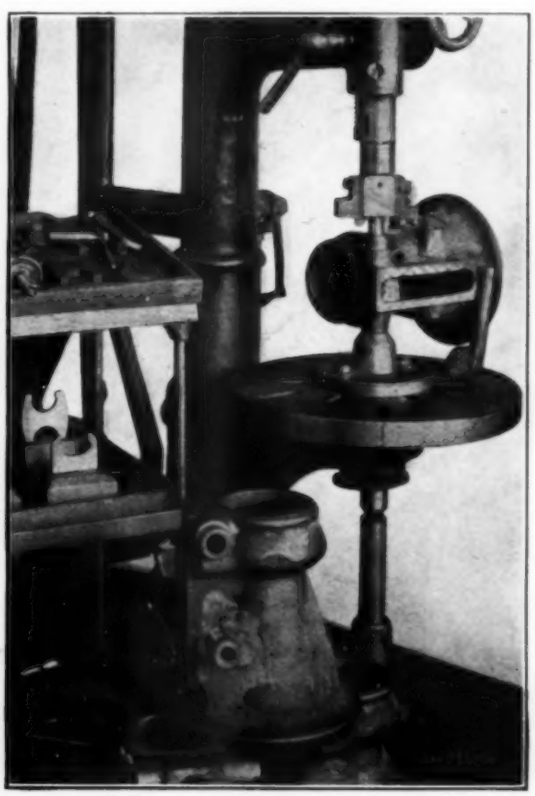


FIG. 9. TURNING A BOSS TO FORM A BEARING FOR A GEAR GUARD

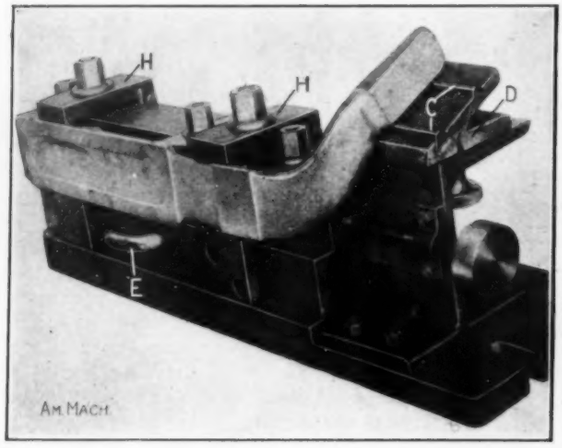


FIG. 14

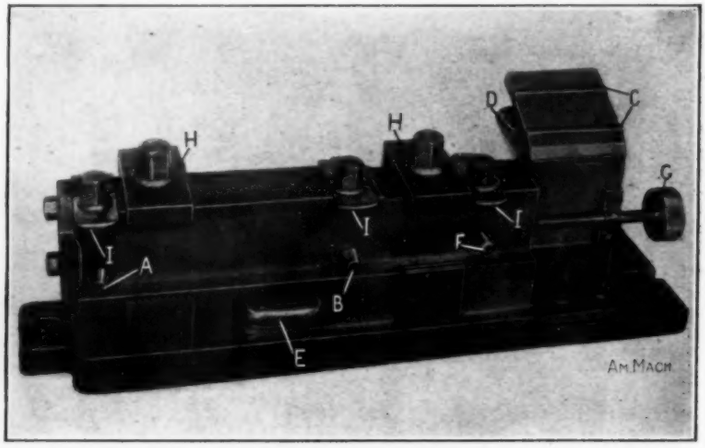


FIG. 15 FIXTURE USED IN MILLING UPRIGHT ARM FOR SEPARATOR

the tools in Fig. 9. The cutter head carries two inserted blades, one for turning the boss, the other for facing and rounding the corner.

The inner ends of the bearings for the lower gear shaft are faced by clamping the work on a central seat on a miller fixture, Fig. 10, and using a flat cutter which is carried in a bar in the miller spindle. The shaft which runs in these bearings must be located endwise very exactly in order that the driving gear which it carries shall engage properly with the spiral teeth on the vertical-bowl spindle.

To face the inner ends of the bosses correctly a dimension is established from the center line and in setting the fixture and machine for the starting of the job a definite relation is fixed between the cutter and the center of the work. With the aid of the micrometer dial on the crossfeed screw the work is fed to the flat cutter until the boss is faced off to the specified distance from the center.

The locating plug in the front of the fixture is slid into the bearing hole in the frame to position it properly before it is clamped to the fixture. The end of the facing bar in the miller spindle enters the bearing for support during the cutting operation.

MILLING AND DRILLING

The separator frame is shown in Fig. 11 on a miller fixture where the rear face of the frame is machined to receive the upright arm that carries the milk pan. The frame is placed on an arbor between the centers on this fixture and is located by the finished bosses so that the milled surface will come square with the shaft bearings and bowl spindle.

The surface milled in this manner is drilled for the screws for holding the upright arm, by means of the jig in the multi-spindle machine, Fig. 12. Here again the frame is carried on an arbor

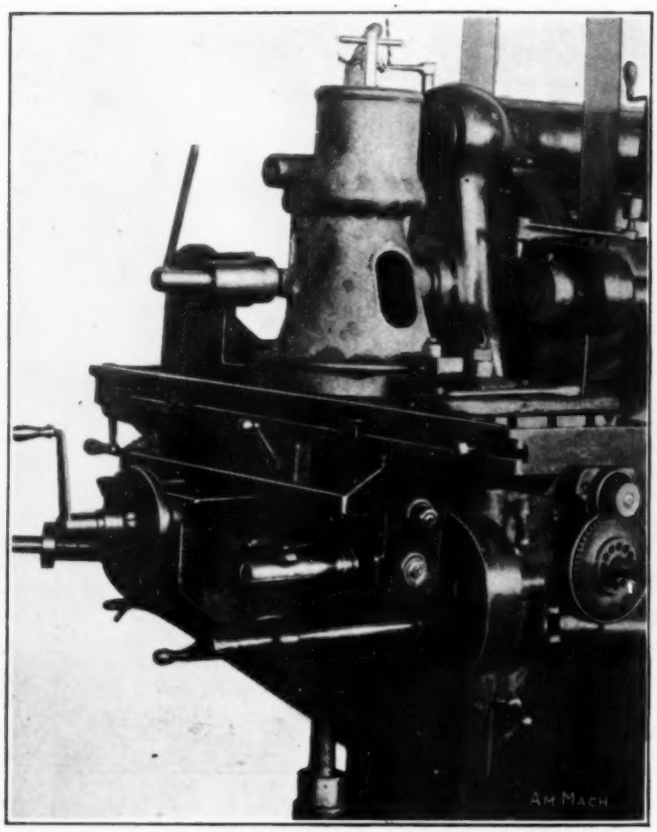


FIG. 10. INTERNAL FACING OPERATION ON THE MILLER

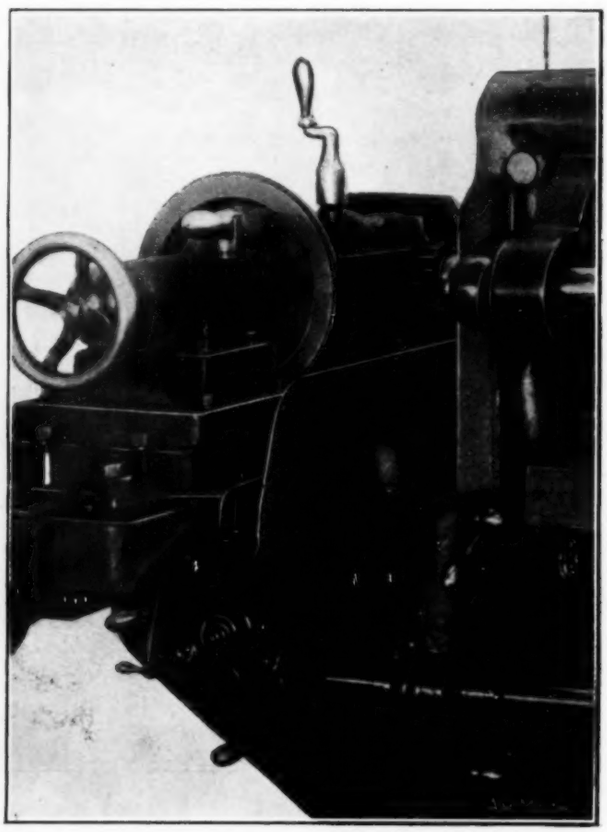


FIG. 11. A FACING OPERATION WITH A MILLING CUTTER

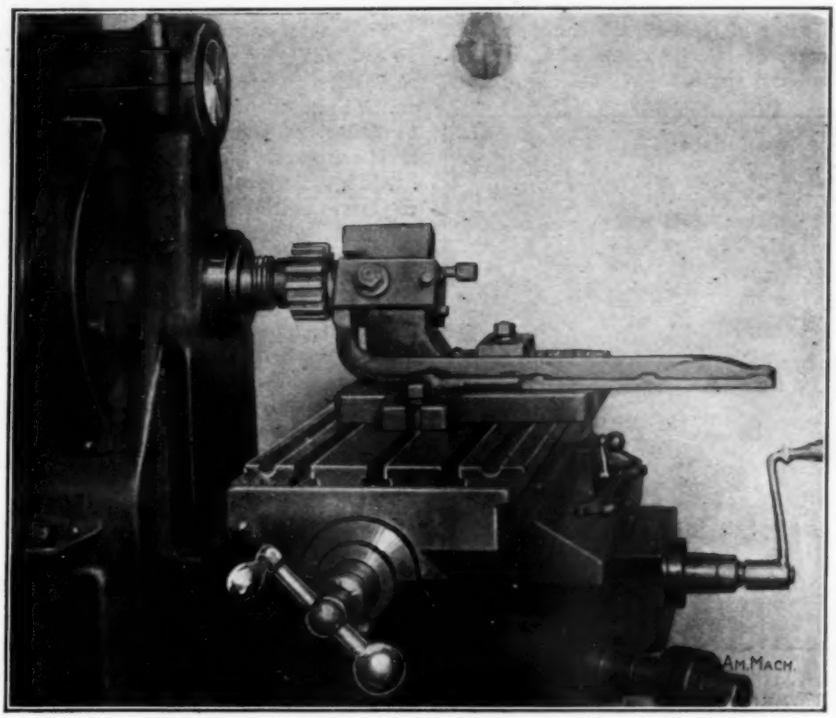


FIG. 16. FIXTURE FOR MILLING END OF SEPARATOR ARM

and a plug is placed through the shaft bearing and jig to position the work squarely under the bushing plate.

MILLING THE UPRIGHT ARM

In Figs. 13 to 16 inclusive are illustrated fixtures used in milling the arm which is attached to the finished surface at the rear of the separator frame to carry the milk pan. The shape of this arm is shown clearly. It will be noticed that this is an awkward casting to hold for the milling operations.

The first operation is the milling of the flat pad on the back of the arm, which is shown to best advantage in Fig. 14. In order that the peculiarly offset arm shall stand in the correct position when attached to the separator frame, it is important that the rough casting for the arm shall be located with direct reference to the bent, tapering upper end of the casting. How the milling fixture takes care of this feature will be seen upon reference to Figs. 13, 14 and 15.

DETAILS OF THE FIXTURE

The casting to be milled is placed first against two fixed stops *A B*, which contact with the work near its lower edge and allow it to swing back until its crooked end rests upon the two hardened V's at *C C*, which are fitted in a sliding shoe *D*. The latter may be adjusted forward or back until both V's are in contact with the sloping end of the cast-iron arm and then a hook-bolt *E* is swung up against the work and drawn up lightly by a nut at the rear. This holds the work for the moment, while a spring plug at *F* is released by the screw *G* and allowed to come into contact with the back of the work, and two clamps *H H* are tightened hard upon the edge of the casting so that it is virtually gripped between two pairs of serrated jaws.

There are three spring stops behind the upper edge of the work at *I I I*, and when these are set into contact with the casting and clamped, the hook-bolt is released and swung down out of the way to permit the milling cutter to be put into operation.

It is obvious that the method of setting the work on the fixture will insure the

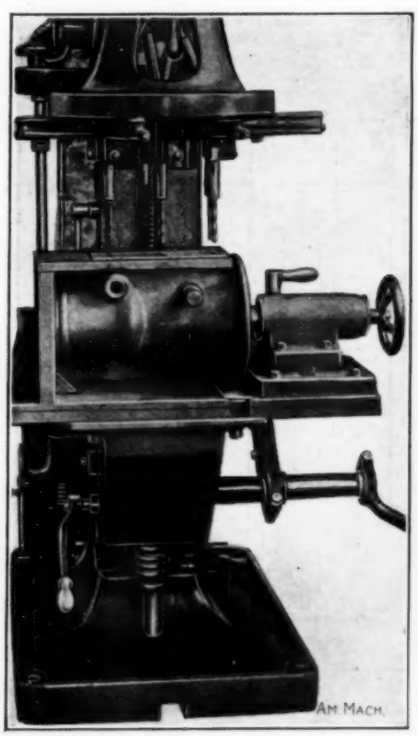


FIG. 12. JIG DRILLING SIDE OF FRAME

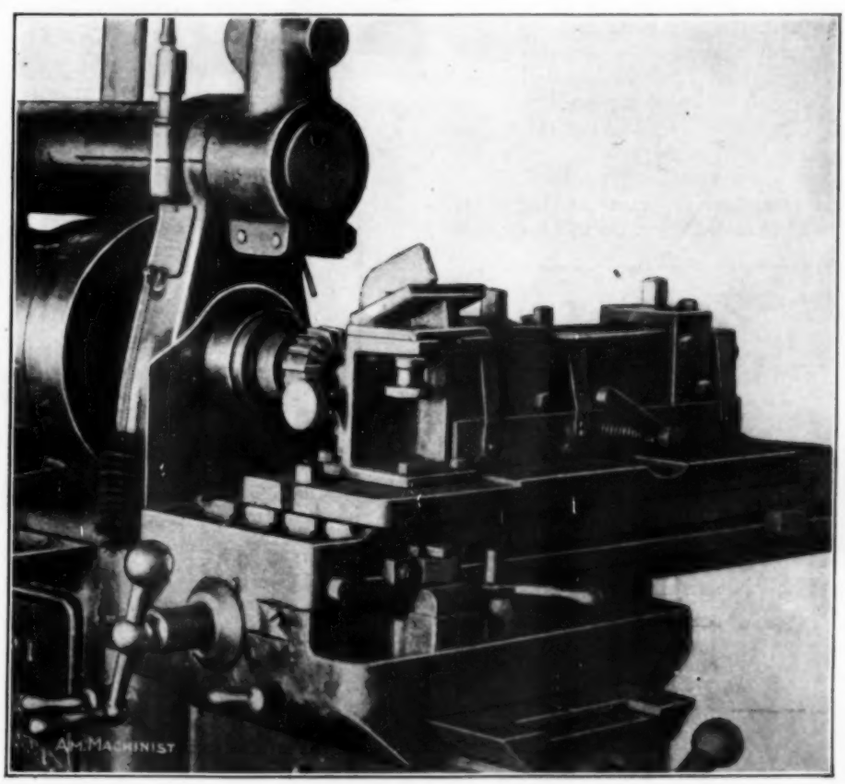


FIG. 13. FIXTURE FOR MILLING UPRIGHT ARM FOR SEPARATOR

milling of the pad at a definite angle with the edge of the crooked extension at the top, and the latter therefore will in all cases have a fixed angular relation to the center of the separator frame.

The outer face of the arm is milled to receive a bracket for holding the milk pan, by means of the fixture in Fig. 16. This fixture locates the casting so that the end will be milled square with the pad faced in the earlier process, and during the cut the work is securely held against spring and vibration.

A Check System for Fixtures and Drawings

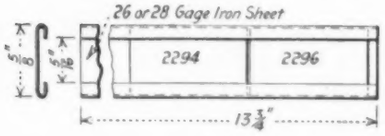
By G. W. Linn

In shops that keep all or most of their tools in one or two places, to be issued to the workmen on their checks, some sort of system must be used to enable the tool clerks to tell at a glance who has these tools and drawings and to be absolutely sure that he has all the parts to a fixture before surrendering the check. It is obvious that the fewer checks issued to a workman the less likely he is to misplace or lose them; at the same time he must have enough to borrow the tools he needs for the job he is working on.

Ten is a good number in most cases, and when a man needs more, fifteen may be issued. There are a great many fixtures with five or six loose parts, so that after the workman has borrowed the standard tools, such as drills, reamers, taps, sleeves, etc., he does not have checks enough to put on each of these loose parts. These parts are slip bushings, clamps, wedges, special-size reamers, facing tools and formed cutters, and, of course, it is out of the question to require the clerks to remember them. To overcome this difficulty, the following system was devised:

An aluminum or brass tag, Fig. 1, is screwed to each fixture. On this is printed the name of the tool, the name and part number of the work, the name of each loose part and the shelf and bin number.

Name Plate for Jigs
Fig. 1



Check Board Details
Fig. 5

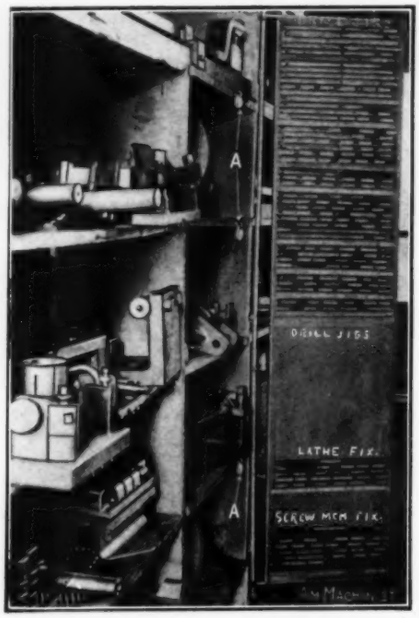


FIG. 2. INDEX BOARD AND BINS

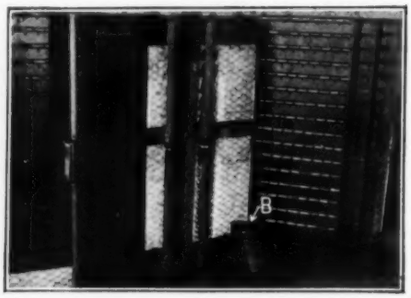


FIG. 3. FOR KEEPING TRACK OF BLUEPRINTS

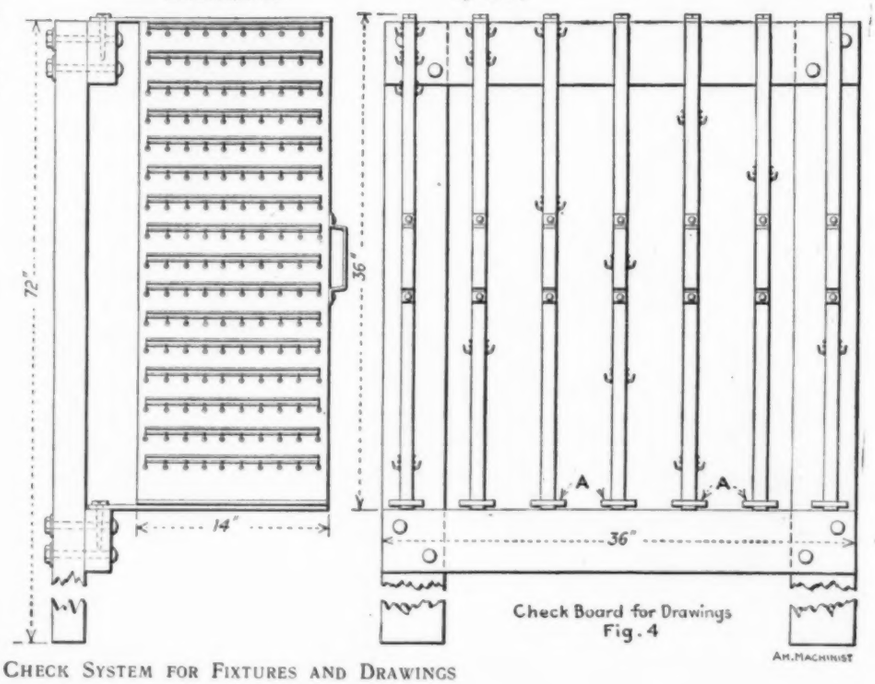
When a workman wants a certain tool, he calls for it by name and part number, as "drill jig for 8829." The clerk looks on the index board, Fig. 2, under the head of Drill Jigs, and finds it is located in shelf or section *H*, bin 22. He accordingly hands it to the workman, who looks at the tag to see that he has all the loose parts. When the jig is returned, the clerk is required to look at the tag and not surrender the check until he has all the loose pieces which belong with it.

The hooks for holding the checks together with a tag bearing the name and part number, are placed on the bins, as shown in Fig. 2, at *A*, *A*.

The system of keeping tab on the blueprints, shown in Figs. 3 and 4, consists of seven movable leaves with nine hooks in a row and sixteen rows on each side of each leaf, making 2016 in all. The pieces at *A*, Fig. 4, prevent the hooks from striking each other. Above each row of hooks is a tag holder, as shown in the detail view in Fig. 5. These tag holders are the same as on the fixture index board and are easily made of black sheet iron, the only tools required are tinner's brake and square shears. The tags are made of cardboard and are easily slipped in and out of the holders. In making up the board, a few hooks are left in each row without tags underneath.

Suppose the drafting room issues drawings 2294 and 2296, and after six months 2295 (see Fig. 5). The tool clerk slips 2294 over to a vacant hook, takes 2296 out and replaces it after 2295 has been inserted.

The card-index box is shown in Fig. 3 at *B*. Factories that are fortunate enough to have part and drawing numbers identical, do not need a card index with this system.



Check Board for Drawings
Fig. 4

A CHECK SYSTEM FOR FIXTURES AND DRAWINGS

A Few Railway Shop Tools and Devices

Editorial Correspondence

A few of the tools and devices in use in a Southern railway shop, which show considerable ingenuity in making the best of the materials and machines at hand.

In the shops of the Chesapeake & Ohio Ry., Richmond, Va., are a number of tools that will be of interest to railroad men.

A chuck for holding packing rings while facing them is shown partly disassembled in Fig. 1. In this *A* is the body of the chuck which screws onto the lathe spindle; *B* is a packing ring, and *C* is the clamping collar. In using this chuck it is placed on the lathe spindle and then the clamping collar, with a split ring inside of it, is screwed on and the packing ring is compressed against the shoulder of the chuck body. Next the plate *D* is put on and locked by means of the T-clamp *E*, and then the clamping ring is removed and the ring finished.

At *F* is a fixture for holding the gooseneck connection *G*, while facing the flange. This fixture screws onto the lathe spindle and the connection is clamped in place by means of the setscrews shown, the threaded end of the connection projecting through the hole, and the back of the flange resting against the end.

Crown Brass and Bullring Mandrels

A mandrel for holding crown brasses is shown at *A*, Fig. 2. The edges of the brass are butted against the crosswebs, and the setscrews *B* and *C* hold it in place.

Bullrings are held on the expanding mandrel shown at *D*. The bullring is slipped over the mandrel and held in place by screwing down the nut *E* which forces the taper plug *F* inward and the six plugs outward. The ends of two of these plugs are shown at *G* and *H*, the others not being visible.

Eccentric Block Mandrel

Eccentric blocks are first placed on the keyed mandrel shown in Fig. 3, and turned true on the outside. This method brings the keyway exactly in the right position without any troublesome measuring or laying out.

Milling Spring Gibs

Spring gibs are milled in a lathe by using a mill on an arbor between centers and the gib-holder shown in Fig. 4, in the tool post.

The gib is placed in the sleeve *A* of the fixture and locked by the setscrew *B*, more plainly shown at *C* in the detached

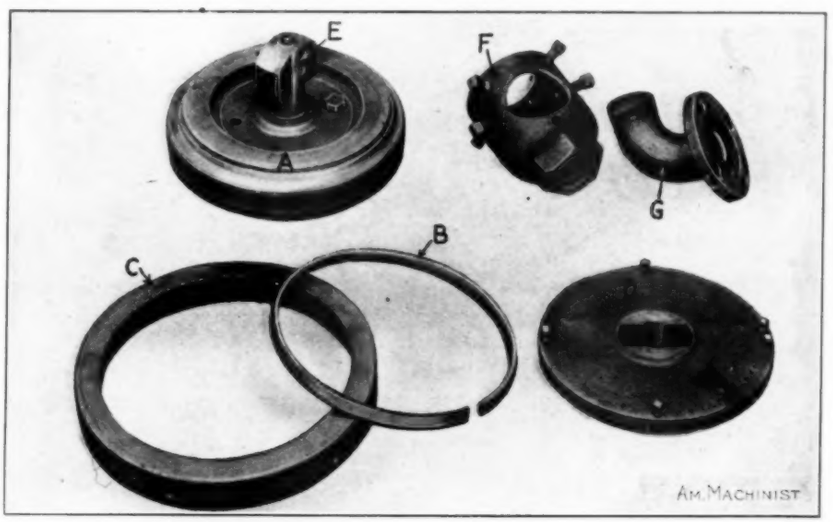


Fig. 1. Chucks for Packing Rings and Gooseneck Connection

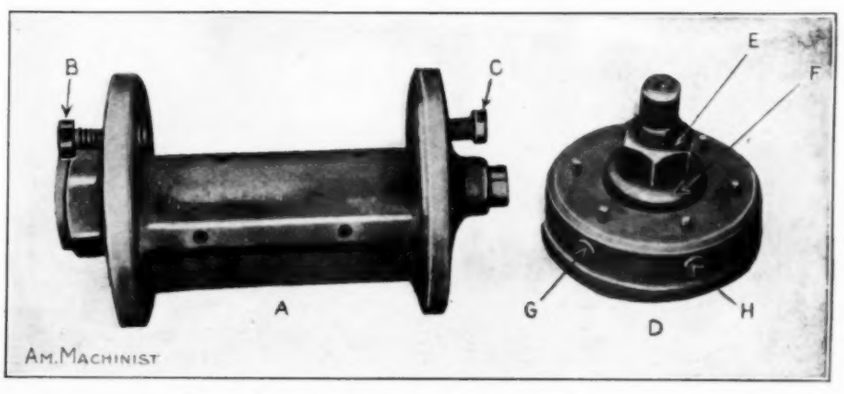


Fig. 2. Crown Brass and Bullring Mandrels

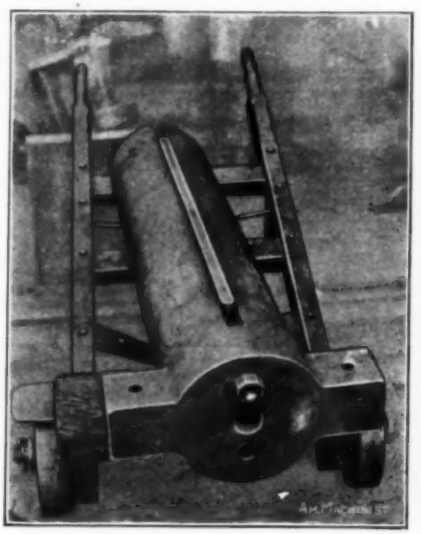


Fig. 3. Eccentric Block Mandrel

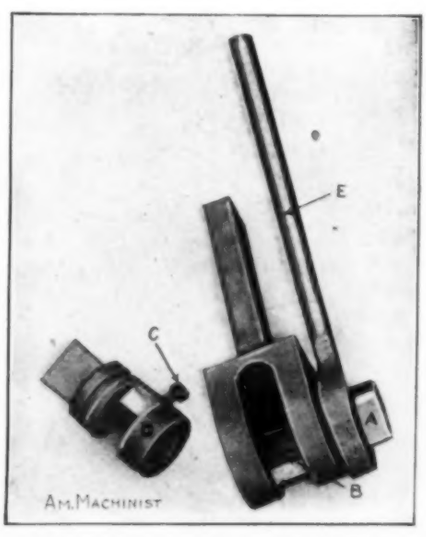


Fig. 4. Device for Milling Spring Gibs

sleeve *D*. The fixture is then moved so that the milling cutter comes between the forks, and the handle *E* is moved until the desired slot is cut in the gib.

Lift Shaft Turner and Other Devices

The ends of lift shafts are turned with the fixture shown in Fig. 5. This is screwed onto the lathe spindle and the outer or guide disk is held stationary in a rest. The end of the shaft is held on the center *A* and a tool at *B* does the cutting, the feeding being done by the star-wheel *C*, striking the pin *D* as the tool and screw revolve.

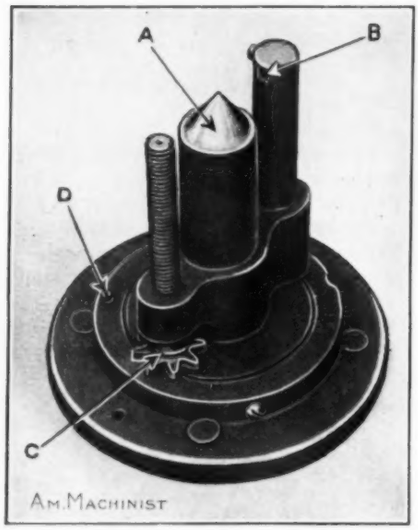


Fig. 5. Lift Shaft Turner

The fixture shown in Fig. 6 is used to hold piston heads while tightening them, the piston head being held by the set-screws *A* and *B* in the claws, the base plate *C* being clamped to the bed of the machine.

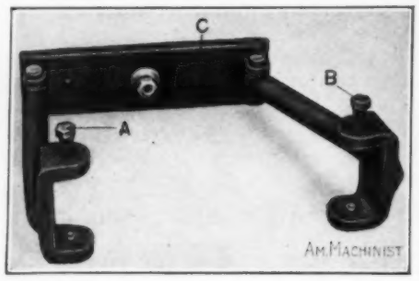


Fig. 6. Piston-head Tightener

The device shown at *A*, Fig. 7, is used to move locomotive driving wheels while quartering, the fork *B* being clamped to the wheel rim, and adjustments may be made by means of the turnbuckle *C*. One of these is, of course, used on each wheel, and ordinarily the wheels are set on rollers like the ones shown in the foreground.

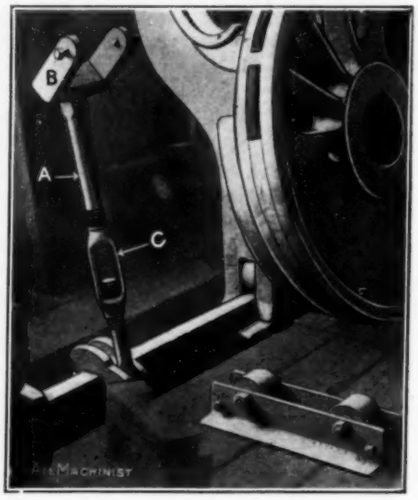


Fig. 7. Quartering Rig

At *A* and *B*, Fig. 8, are an eccentric rod twister and a spring puller, that need no explanation.

A Pneumatic Grinder

A grinder that is very useful on the erecting floor or other places, where air is about the only power available, is shown in Fig. 9. This consists of a small air motor *A*, so mounted as to run the two grinding wheels *B* and *C*. Most of the parts used in the construction of this

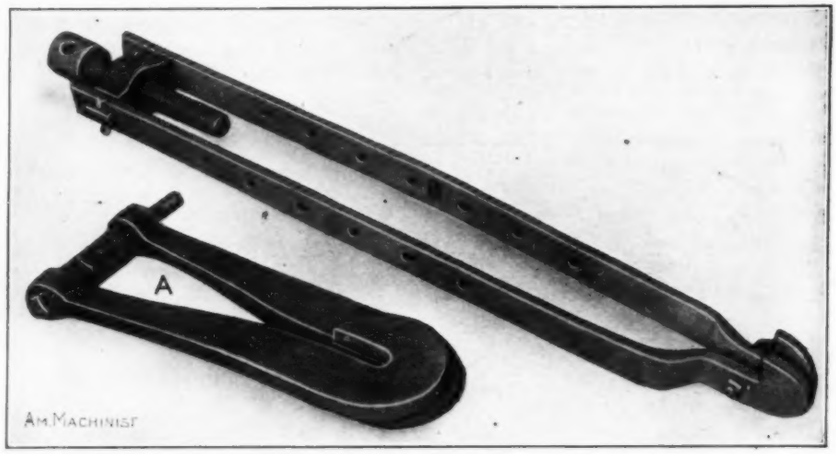


Fig. 8. Spring Puller and Eccentric-rod Twister

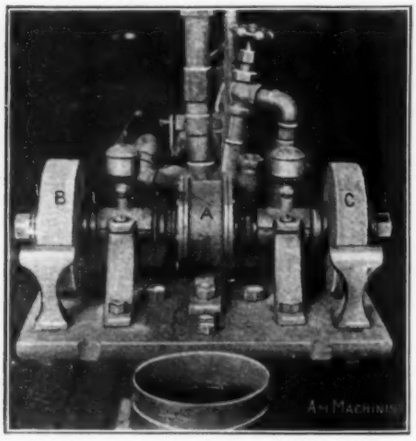


Fig. 9. Pneumatic Grinder

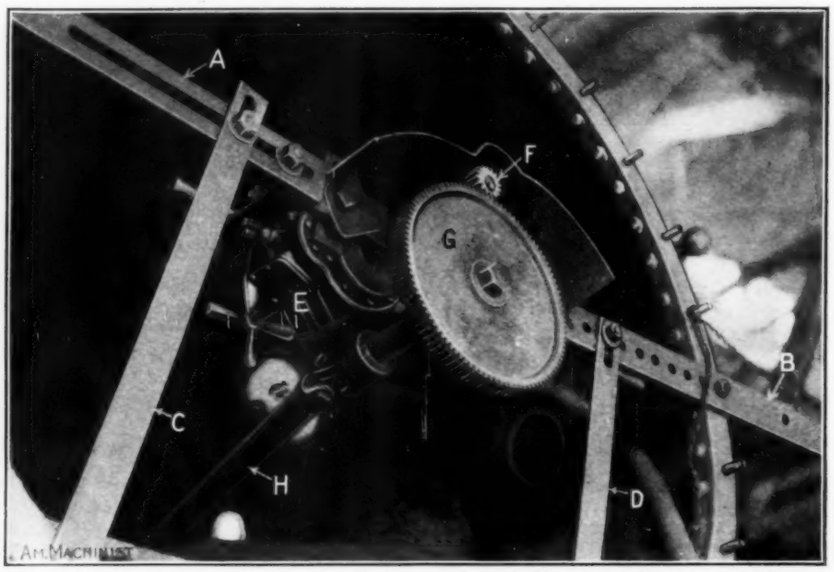


Fig. 10. Pneumatic Flue Cutter

grinder are to be found around any railroad shop.

Cutting Flues with an Air Drill

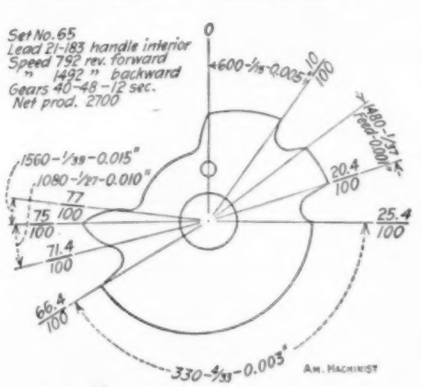
In Fig. 10 is shown a method of using an air drill to operate a flue cutter in a locomotive boiler. The braces *A, B, C* and *D* are bolted to the end of the boiler and carry the air motor *E* the spindle of which holds the pinion *F*. This pinion runs the gear *G* on the end of a universal jointed shaft *H*, which runs the flue cutter. The shaft *H* has a telescoping section, which allows the flue cutter to be inserted in all the flues without moving the air motor.

Milling Screw Machine Cams

By M. Gnett

This method of milling cams for the Brown & Sharpe automatic screw machine has been in successful use for some time and has some advantages over methods previously described.

The shape of the cam is first figured out according to the instructions given in the treatise furnished by the Brown & Sharpe Manufacturing Co. with its machines, and this method has to do only with the milling of the lobes of the cam, after the proper amount of rise and the number of hundredths of the



Milling Screw Machine Cams

circumference occupied on the cam for each lobe, have been determined.

The method consists in mounting the cam to be cut on the dividing head of the miller and setting the head to the number of divisions that will give the proper rise on the lobe of the cam when the cam is fed toward the cutter a definite number of thousandths for each division. The following rule will give the number of divisions necessary to obtain the correct rise of the cam when the work is fed toward the cutter 0.001 in. for each division: Multiply the total rise required in thousandths by 100 and divide by the number of hundredths of the circumference occupied by the lobe; this will give the number of divisions necessary on the index when the work is fed to the cutter 0.001 in. for each division.

$$\frac{\textit{Rise in thousandths} \times 100}{\textit{No. of hundredths of circumference}} = \textit{No. of divisions needed when feeding } 0.001 \textit{ per division}$$

As an example: If the total rise required is 0.375 in. and the space occupied by the lobe is 0.025 of the circumference, the rule would be applied in the following way: 375 the total rise, multiplied by 100 would be 37,500, and this, divided by 25, the number of hundredths of the circumference occupied by the lobe, would give 1500, the number of divisions that it would be necessary to set the dividing head to in order to obtain the correct rise by advancing the work to the cutter 0.001 in. for each division. It is obvious that if the work is fed to the cutter 0.002 in. per division, one-half the number of divisions may be used, or if the work is fed 0.003 in. per division, one-third the number of divisions may be used, etc.

It is not possible always to obtain by plain indexing the exact number of divisions needed with the index plates regularly furnished with millers, but there are a great many divisions that can be obtained which do not appear on the list of divisions usually furnished. For instance, the list supplied with the No. 1 Brown & Sharpe millers does not show any divisions above 360, while there is a large number between 360 and 1960 possible, as shown by the following table.

In the case of the cam just described, it would be necessary to have 1500 divisions in order to get the exact rise required in the exact space when feeding 0.001 per division, but the nearest number of divisions to 1500 which can be obtained by plain indexing is 1560, which would mean that if the total circumference of the cam had been milled at the ratio of 0.001-in. rise to one division, we would have a rise of 0.060 in. in excess of what is needed. But as only 25 hundredths of the circumference is used, we would only have 25 hundredths of this excess, which would be 0.015 more than 0.375 in., which is wanted. If the index were set to 760 divisions and a feed of 0.002 used per division, we would have a rise of 0.380, which is only 0.005 in excess of what is wanted, which would be close enough in practically all cases.

Number of Divisions	Number of Holes in Index Circle	Number of Turns
370	37	4/37
376	47	5/47
380	19	2/19
390	39	4/39
392	49	5/49
400	20	2/20
410	41	4/41
420	21	2/21
430	43	4/43
440	33	3/33
460	23	2/23
470	47	4/47
490	49	4/49
520	39	3/39
540	27	2/27
580	29	2/29
600	15	1/15
620	31	2/31
640	16	1/16
660	33	2/33
680	17	1/17
720	18	1/18
740	37	2/37
760	19	1/19
780	39	2/39
800	20	1/20
820	41	2/41
840	21	1/21
860	43	2/43
920	23	1/23
940	47	2/47
980	49	2/49
1080	27	1/27
1160	29	1/29
1240	31	1/31
1320	33	1/33
1480	37	1/37
1560	39	1/39
1640	41	1/41
1720	43	1/43
1880	47	1/47
1960	49	1/49

TABLE FOR PLAIN INDEXING OF DIVISIONS ABOVE 360

Good practice is to set the vertical milling attachment to a horizontal position and adjust the cross-slide to bring the cutter directly above the cam, then bring the cam to the cutter and index one division and feed 0.001 until the space occupied by the particular lobe has been covered. The waves left on the surface of the cam, owing to the intermittent feeding and indexing, are very slight, and a very little draw filing will take them out.

It is, of course, necessary to use the cutter approximately the same size as the roller which works on the cam. This is more important where the rise of the cam is very rapid.

The cut shows how the cams are laid out by the drafting department for the machine department. The machinist milling the cam has only to follow the divisions and feeds as indicated in order to obtain the correct shape in every case. This method can obviously be applied to cutting other cams than screw-machine cams, and where it is more convenient to figure the circumference of the cam in degrees than in hundredths, the following formula would apply:

$$\frac{\textit{Rise in } 0.001 \times 360}{\textit{Number of degrees}} = \textit{No. of divisions needed when feeding } 0.001 \textit{ per division}$$

Twenty thousand automobiles is the export record of the United States in the fiscal year just ended and their value, including parts and accessories, approximate $2",000,000. Nearly 17,000 automobiles were exported to foreign countries in the 10 months ending with April, valued at 16½ million dollars; parts thereof, 3¼ million dollars; tires, sent separately from machines under the head of exports of rubber manufactures, over 2 million, and automobile engines two-thirds of a million dollars, making a total for the 10 months of practically 22 million dollars. This figure includes only the exports to foreign countries and is exclusive of the 900 machines sent to our noncontiguous territory, valued at about $1,500,000.

Primitive Methods and Tools in China

By F. A. Foster*

Carrying heavy weights on "tote" poles because there are no wagons. The primitive tools of prehistoric times, duplicates of which are still in use. A bow-saw made of bamboo and a piece of round wire, the teeth being cut with an axe.

*Instructor, Engineering College, Tangshan, North China.

During a visit to the interior of China, I was particularly interested in watching the natives at their work and in the tools and methods employed. In some places I was fortunate enough to get photographs; in others, I made sketches for future reference. In most of the workshops visited, it was too dark to get good photographs. The shops are small, and the tools and methods are those used for centuries.

There are large shops connected with the railways and a few concerns under foreign management, such as the cement works, the various mining companies, a few cotton mills, etc., where the native workman has come in contact with foreign influence and has adopted modern ways and tools to some extent. These, however, are comparatively few.

If the new government carries out its liberal policies, there will be many changes for the better in engineering and manufacturing lines, and a good opening for tools and other manufacturing necessaries.

Right here in Tangshan, where our Engineering College is located, there are large cement works, employing several thousand hands. The machinery, I believe, is mostly German. The Chinese Engineering & Mining Co. has large coal mines here and employs fully 3000 hands. The shops of the Imperial Rys. of North China are also located here and employ 4000 to 5000 men.

Most of the machinery and tools are English and of a rather obsolete type. The railway shops build cars and locomotives, not only for their own use, but also for new lines under construction. An attempt is being made to standardize the railway work of the whole country, by having it done, as much as practicable, in one place.

Transportation

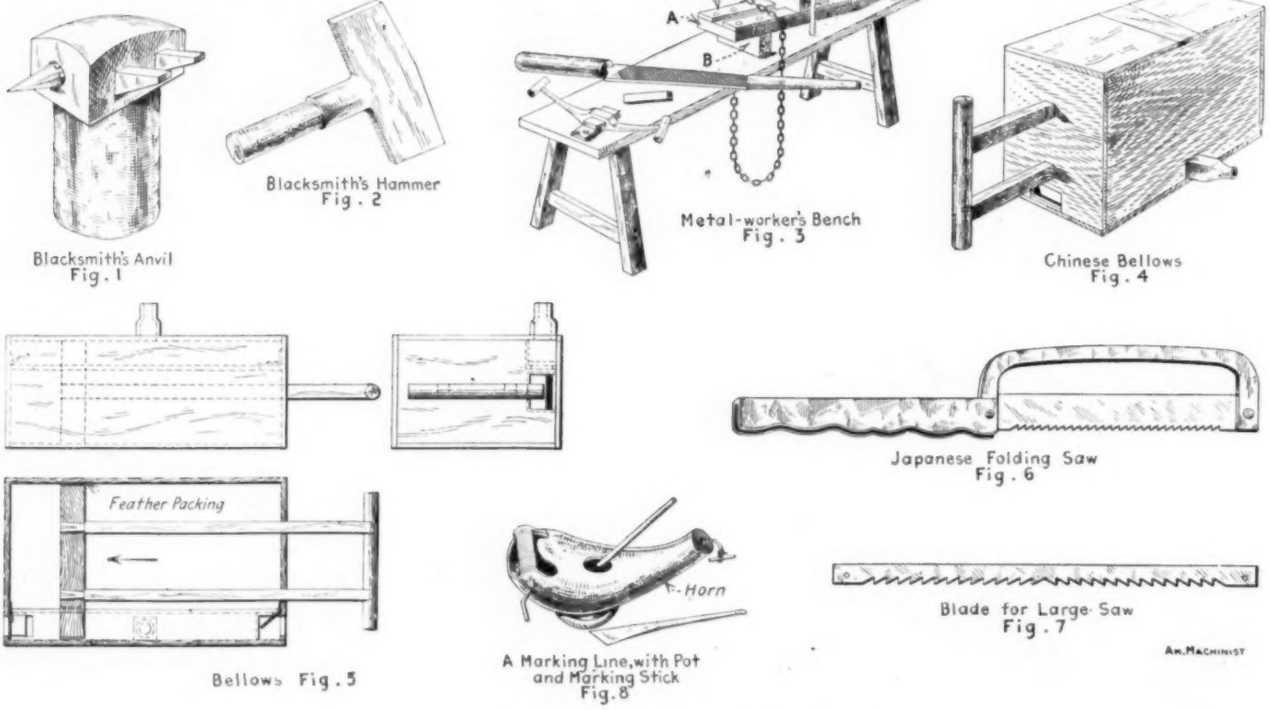
There are railway shops at Hankow equipped with Belgian tools. The Peking-Hankow Ry. was built by the Belgians and later bought by the defunct Imperial government. While at Hankow I saw a gang of coolies carrying a very large boiler plate. The plate weighed some 1800 lb., and was carried by 16 men. Like everything else portable here, they carried it with the aid of "toting poles" and ropes.

There are no horses nor drays used for transporting goods from cars or boats. Everything is either carried suspended from poles, or on the back. In some of the larger cities, where foreign influence is felt, large hand trucks, pushed by men, are occasionally used. Even for long-distance transportation, it is no uncommon thing to see a gang of men traveling across the country, "toting" merchandise on poles.

Here, in the North, long-distance transportation across country is done in carts. In the South, where the roads are fewer and worse, everything is transported by men. The most noticeable feature of these carts is the revolving axle, the hole in the center of the wheel being square. I have seen no four-wheeled carts, except in the Province of Honan. These, however, had no means for swiveling the front axle, and when necessary to turn a corner, it became a matter of pushing and sliding around.

The Blacksmith Shop

While on the Hankow trip, we inspected some 300 miles of railway. At a



Chinese Blacksmiths' and Other Tools

small city, I made the acquaintance of a native blacksmith. Although I could not talk with him, I was able to make myself somewhat understood by the engineer's universal language of sketches. I got sketches of some of his tools. These are shown in Figs. 1, 2 and 3.

His sledge hammer seemed like a foreign affair, but the others were characteristic of the country. The blacksmiths' hand hammers have a very narrow face. That which interested me most, however, was the work-bench and the tools for finishing metal work, shown in Fig. 3. The workman sat astride the bench, and the work was held in various ways by means of the chain, into which he pressed his foot. The inclined portion of the bench can be lowered by changing the position of the block *B*, so that work can be held on *C*, under the iron strap *D*.

There was a very large file, evidently made by the blacksmith, with a long handle on one end and a wooden extension on the other, to go into the ring *E*, which serves as a guide. This might be called a Chinese hand miller.

The other tool shown on the bench is a scraper, or Chinese planer. The cutting tool is held in place by a wedge. Sometimes a pushing cut is taken; at others, a pulling cut. A fair chip can be taken with this tool, which is used to smooth all kinds of wrought iron, steel and brass work.

The range of the blacksmith's work included almost all the metal work required by the community. Among his stock I saw razors, pocket knives, various farming implements, building requisites, locks, cooking utensils, etc. The razors were nicely forged and then finished smooth and to an edge with the scraper shown.

The bellows, Figs. 4 and 5, or one manpower blowing engines, used everywhere over here for producing a blast of air, are quite interesting. They consist of a rectangular box, in which a piston is fitted and moved by a pair of piston rods extending through one end. In the lower part of the box, at one side, is a closed passage with valves in the side at each end, and with an outlet for connection to a pipe.

There are also valves at each end of the box. The piston is shaped to fit the box and has a packing of feathers glued on to make it air-tight.

The Carpenter and His Saws

Many of the things done or used here seem so directly opposed to what we have at home that one is inclined to call this "topsy-turvey land." In a way, this applies to all of this part of the world, Japan included. While in Japan, I was interested to see their carpenters sitting on the ground with a heavy plank as a bench and pulling their planes and saws instead of pushing them, as with us.

In the case of the saws it seems a rational way, for the pulling motion produces a straighter cut and a thinner saw can be used. The saws were nearly all of the frame sort, much like our buck saws.

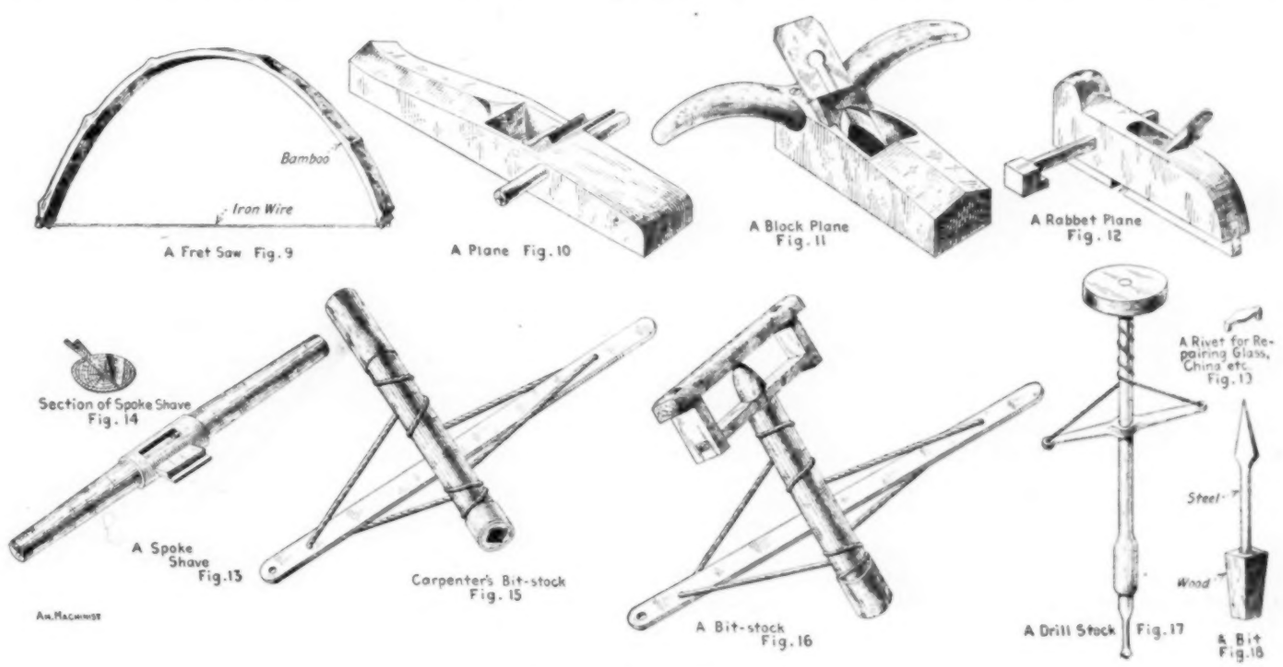
On the steamer at Yokohama I bought a small saw from a peddler. A sketch of this is shown in Fig. 6. It folds up like a knife. The blade is very thin and is used with the pull action. The frame would be better if it were a little stiffer but I have found it quite a useful little tool on several occasions. The steel seems to be excellent.

In Japan, as well as in China, the usual way of sawing logs and timbers into boards and planks, is by means of the large frame saw. As a usual thing, the boards needed in a building or other structure, are sawn from the log right on the premises where they are required.

The teeth of these large saws are pointed in one direction on one-half of the blade and in the opposite direction on the other half. See Fig. 7. The log is first marked off with black lines, both on the ends and along the top surface, for the guidance of the sawyers, much as our carpenters use a chalk line. The piece is then placed in a position so that one man is above and another below it.

The object shown in Fig. 8 is the reel used for blackening string for marking long lines on lumber. The string is drawn through the horn, which is filled with some spongy material containing a black liquid. The wooden marking stick is made with a chisel-shaped end and is used for marking lines along a straight-edge or square, instead of a pencil. It is dipped into the black sponge in the horn and will make a long mark before requiring to be dipped again. Used on the end of a scale, with the aid of the thumb, it serves as a scratch gage.

Squares are almost always made of wood and are home-made. They also have home-made scales of wood. Nominally, I believe, there are standards of measurement but their use is not strictly enforced and so there are variations in different parts of the country. Foreign-made rules and scales are much used wherever foreign influence is felt.



Chinese Small Tools

Another saw which interested me much, was given to me by a Chinese cabinet maker whom I had occasion to employ. Among other things, I required some tills to go in some drawers: In making these, he made dovetail joints. In sawing the dovetails, he used a small frame saw to cut in from the edge of the boards, to the bottom of the joints. In order to cut along the bottom of the recesses of the dovetails he used a saw which he made from a piece of bamboo and a piece of iron wire. See Fig. 9.

Having made the bow by fastening the wire securely at each end, so that it was under considerable tension, he laid the wire across the corner of the bench and proceeded to cut fine teeth with his hatchet. The wire was of a diameter of the width of the saw kerf, already made, permitting the wire saw to be inserted to the bottom of the previous cuts, turned and the cuts along the bottoms of the dovetails made, parallel to the edge of the wood. His work was truly surprising, and when the sawing was done the work was ready to put together without any further trimming. The teeth on the wire were very small but cut nicely.

Chinese Planes

Chinese planes are pushed like ours but they have some different features worthy of note, viz: The handles and the position of the cutting edge. The blade is placed so that the cutting edge is in the middle of the length, instead of forward, as with ours. They are invariably home-made. They very seldom use a "cap-iron." The handles are of two styles, those having a straight, round bar passed through the body, and those with a handle saddled over the top. These are shown in Figs. 10 and 11.

These handles give a good control over the plane. Instead of having a shoulder in the wood, for the wedge, they often have a round iron pin driven through the side of the body, as shown in Fig. 10. The wood used in these planes varies with the local supply. I have seen them made of oak, teak, greenheart, locust and even of rosewood. I have had some made from oak and teak for our college workshop and they give fine results. Fig. 12 shows a small rabbet plane.

A home-made spoke shave from the cabinet maker's kit is shown in Fig. 13. In the middle of the wooden handle is an iron ferrule, through which the throat is cut and a flat blade, held by a wedge, is inserted. Fig. 14 is a section through the middle.

Drills and Boring Tools

There are two types of drilling apparatus in common use here, both of very ancient type as shown by old pictures and descriptions. One is the "bow drill," Figs. 15 and 16, and the other has the handle sliding freely up and down the spindle operated by straps attached to a spindle. See Fig. 17. This type has a heavy balance wheel at the top of the spindle. The bow drills shown in Figs. 15 and 16 are Chinese bit stocks. The spindle revolves freely in the handle at the top.

The common type of bit used here is shown in Fig. 18. The point is very long and sharp. The square end is of wood, into which the metal is driven. I have seen small bits made from a piece of scrap wire or an old wire nail, as occasion required.

For small holes in hard substances the Chinese use a drill made by inserting a bit of diamond in the end of a piece of steel wire. With such a drill they do wonderful things in the way of repairing glass and chinaware.

Riveting Crockery

A peculiar feature of life here is that of the domestic service. All the housework, cooking, etc., for foreigners, is done by men, each having his specialty. They all have one characteristic, in common, viz: The ability to break anything breakable. No matter how strong a thing is, they can break it. This accomplishment gives employment to a large number of traveling "tinker men" who travel about with quite a complete little equipment for repairs of all kinds.

Crockery, glassware and china dishes are mended time and time again even though broken into a dozen pieces, by means of a peculiar rivet. A hole is drilled part way through the material near a broken edge with one of these diamond-pointed drills, and a rivet, like that shown in Fig. 19, is selected from a stock of various sizes. One leg of the rivet is inserted in the hole and the point on the adjoining piece located. The hole is then drilled so that when the rivet is pressed into place, there will be a slight compression on the joint. If the rivet will not reach the second hole properly, it is lengthened a trifle by a light tap on the flat center portion.

Scientific Office Cleaning

By R. E. Marks

I recently overheard two shop janitors talking over their troubles and as I have not yet reached the point where I close my ears to all suggestions which are not the result of motion study, stop watches and slide rules, I listened rather intently and the more so as the conversation progressed.

"An' how is the new system working in your shop, Dinny boy? I hear ye have a time table fer iviry blessed move ye make the whole long day."

"Right ye are, Michael. But it's a grate scheme. I don't have to use me brains at all."

"Yer brains is it? Sure ye have none to use; ye mane ye simply quit trying to pretend ye have brains."

"Have that as ye will, Mike. But here's me skidule fer a part of the morning."

	Minutes	Hours	Bonus
Morning work. At seven o'clock leave the locker room, go to the office and collect five cuspidors, return to the locker room, clean cuspidors thoroughly, get water pail, broom and mop, lock locker room and assembly room doors, return to office and distribute cuspidors to their places	9	0.15	$0.0075
Clean four office lavoirs and the president's private washroom, polish nameplate and hand rail outside front office and polish 11 nameplates on doors opening into office lobby, lavoirs, and return to locker room	36	0.60	0.030
Go to die-shop closets with broom, mop and hot water, and thoroughly sweep and scrub same, and clean hand basin at the foreman's desk and return to the locker room	9	0.15	0.0075
Thoroughly sweep the superintendent's office, dust the furniture and clean out wash basin; then return to locker room, taking the superintendent's cuspidor along. Thoroughly clean the same, leave pail and mop in its proper place, take broom along and return the superintendent's cuspidor and continue to the tool room	9	0.15	0.0075
Rest period, if wanted.	12	0.20	0.010
Go to boiler-room closet with broom, mop and hot water, thoroughly sweep and scrub the same and return to locker room	9	0.15	0.0075

"Shure if I hadn't larned to rade last winter I'd lost me job. Not that I can clane the floors and windys and spitcuspidors any better than I cud before, but I just follow the bill of fare as the byes call it, and everything is lovely."

"But sphose some wan puts up a new nameplate or a new door—do you clane that too?"

"Not without a new time table. An I'd clane the whole shootin match just the same if the hull dommed office went to Atlantic City fer the Summer. If I didn't 'twould bust the system, d'ye see?"

"An do ye git the bonus, Dinny?"

"I did, till the boss found me extry 7 cents a wake was comin' too often, so he invinted a new method of doin' the work."

"How's that?"

"He bot a new broom when the old wan wore out and he cut the swapeing time two minutes. But how does your shop run? Don't ye hev any skidule to work by?"

"Nary one. The boss says to me: 'Dinny, it's up to ye to keep these offices swate and clane. I'll give yez two dollars a day to do it and I'll fire ye if ye don't.' And nather wan of us worry about time tables or bonuses. An if ye think the offices aren't clane—come over and see them."

The Status of Co-operative Schools

By Charles H. Winslow*

The author favors the co-operative school plan as the solution of industrial education, and maintains that this plan is a necessary feature of our public school system.

Descriptive analyses of the work being carried on at some of the various co-operative schools in this country.

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A recent article discussed the subject of apprenticeship schools, or schools conducted by employing establishments for the instruction of apprentices in the processes and practices, as well as the related theory of the machinists' trade.

The purpose of this discussion is to outline the present status of what is becoming generally considered the most practical plan for instruction in the trades, or, in other words, coöperative part-time schools.

While coöperative schools differ materially in their operations, inasmuch as their coöperation is effected in various ways, the purpose remains the same. Almost every locality having a scheme of coöperative education has planned it to meet the needs of that particular locality. These schools are conducted for the instruction of apprentices under an agreement, usually between the public schools and the employing establishments, the latter usually making it mandatory on the part of apprentices to attend such schools.

It is to the credit of the manufacturers that the first step in the movement for such schools was taken by them. However, this step was taken to meet the need of large numbers of manufacturers who found it expedient to provide schools, or courses of instruction, for apprentices in their own shops.

Co-operation in Vocational Guidance

The coöperative-school plan is an attempt to combine training in the processes and practices of trades, in manufacturing or other establishments, with general instruction in a school which includes theory plus academic studies that bear directly on the trade work. The details of such systems vary, but the most popular is the half-time plan.

While efforts have been made to establish and classify schools to give the various kinds of vocational instruction, little or no attention has been given to the necessity for preparation of both pupil and teacher for such instruction. It therefore becomes desirable to point out that aside from the chasm which seems to exist between the grammar grades and the high school, and the fact that many of the pupils must go to work, there is a subtle, underlying, active something which is largely ignored or lost sight of.

This is believed to be an actual psychological condition, based upon and connected with mergence into manhood. A thorough study of the subject would doubtless establish the fact that this has more to do with the resignations from school at that time, than the necessity of going to work, or the existence of a possible hiatus between the grammar and high schools, or any other factor.

There is no doubt that the first eight years of school work should be cultural in its nature because of the fact that a boy's occupational bent is undeveloped and his likes and dislikes are subject to change. His character and habits during these years are in a formative stage.

Boys, with very few exceptions, during this period, do not know what occupations they would like to follow, and to assign them arbitrarily to any particular occupation would be illogical and perhaps vicious. How then can we keep them in school a few years longer and give them at least elementary training for some occupation? Obviously, the answer is, through coöperative part-time schools.

A thorough study should be made of the peculiar psychological changes that take place at this period of a boy's life. He should be aided as far as possible to determine, at least tentatively, on a calling for life. The physique, temperament and intelligence should all be taken into careful consideration in connection with this psychological study, in order to make a helpful, and at the same time useful, suggestion to the boy.

Manual training, as it exists at present, could be sufficiently specialized to afford a tryout to prospective apprentices, thus determining their bent or adaptability to specific trades. This means that the manual-training work would no longer be taught by a professional pedagogue, but by an experienced and practical journeyman, or other person in the trade, with sufficient adaptability and training as a teacher to impart his knowledge, and, at the same time, gain the confidence of the pupils in the practice classes.

As great a variety of occupations should be provided as is possible, depending upon the size of the town or city. In towns and cities having only one high school, it would easily be possible to give a thorough preapprenticeship course of at least two years in certain trades, and for the remaining two years, other courses might be given to that portion of the class that did not take trade or occupational work the first two years. In this way, the desires of practically all the students could be met.

In the last analysis, industrial education will be measured by intensely practical men of the industrial world, on the basis of skill and intelligence, as developed by these undertakings, to fit the youth of the country for wage-earning occupations. In order to meet this test successfully, apprentices must be trained under real conditions in productive industry, thereby making the co-operative-school plan a necessary feature of our public-school system.

Some Reasons Why Co-operative Schools Should Be a Public Charge

1. Because of the very nature of things, past and present, the general public has confidence in a public-school system.

2. The manufacturer ought not to be expected to run his establishment to teach trades; nor can he be criticized for making "machine specialists" instead of all-around machinists, when one takes into consideration the fact that he is working to accomplish a very definite end; that is, to turn out a product.

3. The public schools should teach the theory of the trade, while the actual practice and processes should be taught in the shop. This method permits of continuous development of capacity and relieves the manufacturer of the expense of the theoretical instruction, and provides a means of weeding out boys who are not adapted to particular trades.

4. By this method the boy, the employer and the community are benefited. The obligation to provide industrial education of a theoretical nature, therefore, should rest entirely with the public schools.

Co-operative Half-time Schools

While coöperative schools differ materially in their operations, one group is quite distinct. This is the half-time school, in which the pupil is in the school half the time and in the employer's shop the other half. The other schools—part-time schools—provide for only short periods of instruction each day or week, or provide instruction for a stated number of weeks in the year; all, however, under a coöperative arrangement.

The most popular scheme for coöperative half-time schools is one in which the apprentices spend alternate weeks in the school and in the shop, one boy being in the school while the other is in the shop. This plan requires two boys to each job.

In this alternating system the school work is closely correlated with that of the shop and comprehends more or less cultural work, such as industrial geography, industrial history, chemistry of materials, shop physics, civics, shop and business English.

It is becoming common practice in many of these schools to defer the shop work until the beginning of the second year of the boy's apprenticeship, all of the first year being devoted to school work, while the other two, three or four years are devoted to the half-time plan.

Another most interesting, as well as invaluable scheme in connection with the coöperative half-time school is the introduction of the "shop coördinator," whose functions are to coördinate the practice in the shop with the instruction in the school by teaching the apprentices one week in the school and the next week in the shop, the theory being that the "shop coördinators" must be practical men, understanding thoroughly the practical, as well as the theoretical side of the trade.

Since all of the coöperative half-time schools throughout the country are of such recent origin, and in view of the fact that none of the schools giving a four-years' course has yet graduated apprentices from its full course, it is extremely difficult to describe the many actual advantages of coöperative schools.

It is generally conceded by the advocates, supporters and directors of this plan of education, that the rapidity with which apprentices have developed under it shows marked advantages over the old-time method of apprenticeships.

Beverly Co-operative School

Probably the most noteworthy example of the coöperative half-time plan is the Beverly-United Shoe Machinery Co. School. This school was started in September, 1909, and at present has 61 apprentices. It differs from almost every other school of a coöperative nature inasmuch as all the apprentices are employed by the United Shoe Machinery Co., of Beverly, Mass. Nearly all of the other coöperative schools have apprentices in several of the employing establishments in the localities where the schools have been established.

The aim of the Beverly school is to give elementary instruction in the machinist trade to any boy who can qualify for entrance; that is, boys having completed the sixth-grade school work. During the year the public-school side of this coöperative plan purposes to give the boy theoretic instruction during its session of 50 weeks, or from Aug. 1 to July 16.

The plan is as follows: One week half the boys are in the factory; the next week, accompanied by the shop coördinator, the same boys spend 38¾ hours in school (from Monday to Friday), while the boys who have been in the school the preceding week are at work in the shop under the instruction of a different shop coördinator or teacher.

The theoretical work done at the public school comprehends instruction in shop mathematics, mechanical drawing, blueprint reading, mechanics and industrial chemistry, civics and industrial economics, arithmetic, shop and business English.

The practical side of this plan or rather the shop side, uses no so called "practice material." The apprentices are employed on actual productive work, making machine parts from castings brought directly from the foundry of the United Shoe Machinery Co. to the machine shop.

The boys are constantly under the direction of the shop coördinator and each boy performs several different operations upon a casting during his week in the shop. The same tests are made of the work of the boy by the company's inspector that are made of all other work, and if accepted, the work passes into the general stock of the company.

The apprentices are given practical and individual instruction by the coördinators on all the latest types of machine tools contained in a modern machine shop. The practice shop, where instruction is given to the boys, has been especially equipped for that purpose at a cost of nearly $50,000 and is set aside for the instruction of apprentices to the machinist trade.

Aside from the two coördinators mentioned, there are shop assistants or assistant instructors who give their entire time to the instruction of the apprentices in the shops. The plan of payment for the productive side of this coöperative scheme is as follows:

The company keeps a separate account for the practice shop, debits it with all cost of maintenance, and credits it with the full value of all the products accepted. Half the piece price is paid to the boy; the other half goes to maintain the practice shop; or, in other words, the boy is paid for half of his actual earning capacity.

The expenses of this school are borne jointly by the public-school authorities and the United Shoe Machinery Co. The high-school building is used for school work. The laboratories of the Mechanic Arts High School furnish the accommodations for the theoretical side of the plan.

The public-school authorities furnish three teachers, while the company furnishes two for the school instruction. Half the salaries of the two shop coördinators are paid from school funds, the other half being paid by the company. The salaries of the public-school teachers are paid by the public-school authorities.

Fitchburg Co-operative School

The Fitchburg, Mass., High School's coöperative industrial course differs from the Beverly Coöperative School in that the latter aims to give an elementary course of instruction to apprentices, while the Fitchburg school strives to give boys of high-school age an opportunity to learn a trade and at the same time continue their school training.

The Fitchburg school was inaugurated in September, 1908, a year earlier than the Beverly school. The Fitchburg Iron Workers' Association, an association of manufacturers, was instrumental in the establishment of this plan. The Fitchburg school differs from the Beverly school, inasmuch as the apprentices attending the former are employed by the several machine-tool manufacturing establishments of that city, instead of by one large corporation. Again it differs from the Beverly plan, for the reason that the apprentices must spend the entire first year of their course in the high school.

The first two months of the second year, or during July and August, the apprentices serve a probationary period in the shops of their prospective employers.

Shop Work

While there is no official scheme of coordination by instructors, in the Fitchburg plan, there is an understanding between the school instructors and the shop foremen, that apprentices are to be advanced as rapidly in the shop-practice work as their ability to progress permits.

During the two months of the probationary period the apprentice is thoroughly tried for his fitness and adaptability for the trade. He is privileged to consult with his school instructor during this period, and if the instructor and the employer believe it is to the advantage of the boy and the employer to learn the machinist trade, he then becomes regularly indentured to the employer.

This scheme is carried on with the employers by prospective apprentices in the several shops until the first of September, when the boys are divided into pairs. At this point, the actual coöperation begins by each boy spending a week in the shop and the alternating week in the school. From Monday to Friday, one boy spends the entire day in the factory and the other attends school from eight to one o'clock.

In addition to the school work, three hours per week of home study are required of each boy during his school week. On Saturday both boys are at work in the factory in order that the boy who who has been in school during the week may sufficiently acquaint himself with the work his alternate has been doing to take it up and carry it on the following week, while his alternate is in school.

The apprentices are at work in the shop during all school vacation periods, with

the exception of a two-weeks' leave of absence in the summer.

School Work

The theoretic side of the plan, which is divided into 40-minute periods and which covers the entire term of the apprenticeship, is as follows:

First Year—The subjects taught in the first year are: English and current events, five periods; arithmetic, five periods; algebra, five periods; free-hand mechanical drawing (tables and simple shop problems) with bench work, eight periods. The school studies relate closely to shop work.

The laboratory work which the pupil receives during the first year consists of instruction in the operations of lathes, planers, drilling machines, with bench and floor work and such other machine work as pertains to the particular branch of machine-shop practice as will be applicable to the particular branch of the machine industry in which the apprentice expects to be employed. This laboratory practice is continued throughout the entire four years of the coöperative school course.

Second Year—English, five periods; shop mathematics, five periods; physics, four periods; civics, two periods; mechanism of machines, five periods; free-hand and mechanical drawing, six periods.

Third Year—English, five periods; shop mathematics, five periods; chemistry, four periods; chemistry, four periods; physics, four periods; mechanism of machines, five periods; first aid to the injured, one period; free-hand and mechanical drawing, six periods.

Fourth Year—English, five periods; commercial geography and business methods, two periods; shop mathematics, four periods: mechanism of machines, four periods; physics, electricity and heat, four periods; chemistry, six periods; free-hand and mechanical drawing, five periods.

The above studies are closely correlated with the shop work. The English studies include forms of business papers and business English. A close study of shop terms and their significance is an important feature of the school work. Industrial history includes the study of daily happenings in the industrial world, the history of the iron industry, the factory system, new inventions and a close study of mechanical journals.

Shop mathematics deals with problems on cutting speeds and feeds, gearing, strength of materials and general cost finding. Mechanism includes a study of the consturction and use of the various machine-tool parts. Physics becomes a study of the laws underlying mechanics; the study of working examples is emphasized. Chemistry takes up the nature and qualities of metals and salts, and tests that can be ordinarily applied to fractured metals, hardening, tempering and improving processes.

Commercial geography includes the study of the source of supplies for various industries, methods of transportation, cost of materials, railway systems, waterways, etc.

There are three instructors in the school; one teaches shop and business English, another the sciences, and the third teaches shop methods and operations and industrial geography.

Summation

The preceding descriptive analysis purposes to show in considerable detail the workings of two types of half-time schools, i.e., the elementary and the secondary type, the former for boys of about 14 years of age and the latter for boys who have reached the age of 16. This analysis is sufficient to show the general scheme adopted by nearly all the half-time schools established within the past four years.

Name of school and location	Year of establishment	Minimum age for entrance	Years in course	Weeks of school in year	Hours of school attendance per wk.	Pupils entering must have passed	No. of pupils in course
Fitchburg High School, Fitchburg, Mass.	1908	16	4	20	23½	Gram'r School	80
Beverly-United Shoe Machinery Co., Beverly, Mass.	1909	14	2	25	38½	Sixth grade	66
Technical High School, Providence, R. I.	1910	14	4	20	23½	Gram'r School	42
Freeport High School, Freeport, Ill.	1909	15	4	20	26¼	Gram'r School	25
Lewis Institute, Chicago, Ill.	1909	16	2	24	40	Gram'r School	68
Cincinnati High School, Cincinnati, Ohio	1910	16	4	48	24	Eighth Grade	175

In the schools in Fitchburg, Mass., Providence, R. I. and Freeport, Ill., the first year of the course is spent entirely in the school, the remaining three years are devoted to the half-time plan.

TABLE I.—CO-OPERATIVE HALF-TIME SCHOOLS.

Table I shows the principal schools which have adopted a coöperative half-time plan, and gives a survey of the principal data concerning them.

Co-operative Part-time Schools

Coöperative schools may be half time, part time, or continuation; usually the part-time school is a continuation school, but not necessarily so. Of the latter types, the part-time plan is one in which apprentices work regular hours in the establishments where they are employed, except for a few hours a week, when they are excused from shop work to attend school.

There is, however, another type of the part-time school which differs materially, inasmuch as the apprentice spends not a part of a day a week, but a few weeks of the school year in theoretic study of his trade.

The instruction in the part-time school is usually in public schools, but is becoming very common in philanthropic as well as Y. M. C. A. schools. The usual studies such as English, spelling and elementary industrial science, with shop arithmetic and mechanical drawing are provided.

Cincinnati Co-operative Continuation School

The Cincinnati Coöperative Continuation School is without doubt the leading exponent of the part-time coöperative school. It is distinctively a creation of Cincinnatians. It was established in 1909 for the purpose of permitting boys at work in machine shops operated by members of the Cincinnati Metal Trades Association to continue their studies, especially such studies as are closely connected with machine-shop practice, the aim being to coördinate with the training received in the shop the academic studies in school, and to increase the intellectual and industrial efficiency of the boys.

The entire expense of the school is borne by the Board of Education, and amounts to about $5000 a year. It includes the salaries of three of the teachers and all the supplies and equipment. There are also about 18 men on the faculty who lecture to the classes without pay.

Some magnitude of the undertaking can be gleaned from the fact that there are approximately 250 apprentices in the school. There is a considerable waiting list, and pupils are accepted whenever there is a vacancy. The only requirement for entrance is that the apprentices shall have a common-school education.

Any apprentice 16 years of age, or over, whose employer will give him time to attend, is accepted in the school. Apprentices are not compelled to attend by their employers, but most of the shops make employment contingent upon attendance, which, of course, amounts to compulsion. The general plan is as follows:

Each apprentice spends four hours per week in school and the remainder of the week at work in the shop of his employer. It is proposed throughout the four years to devote 45 minutes of the time each week to mathematics, 45 to science, 1½ hours to the theory of shop practice, 45 minutes to general culture and 15 minutes to physical culture. The following

are the subjects taught in the four years' course:

FIRST YEAR SUBJECTS—Shop arithmetic, spelling, reading, composition, reading blueprints, drawing, geographical relations of the shop materials, and civics.

SECOND YEAR—Objective geometry; science—iron, its manufacture and founding; blueprints, mechanical and free-hand drawing; shop practice—shop conventionalities and necessities; civics and the reading of the lives of the world's improvers.

THIRD YEAR—Geometry and algebra, physics, shop practice, foreman's question box, drawing, civics and economic history of literature.

FOURTH YEAR—Trigonometry and applied mathematics; shop chemistry; shop practice—visiting industrial plants and discussing observations, especially of economy and waste; culture—the man as a wage earner and citizen; debates.

The school aims to accept the conditions presented by the trade and to accommodate itself to those conditions without a thought along the line of changing the conditions. This necessitates some compromises, as the shop cannot send a boy to the class in which the instructor would like to place him, in some instances, and it has compelled the school to find a course of study which is flexible.

The apprentices from the machine and pattern-making departments are treated as one and the same type, and are divided into nine sections, each section spending a half day each week in the school for 52 weeks a year and for a period of four years.

The nine classes are arranged beginning on Monday afternoon and finishing on Friday afternoon, so that the less prepared pupil comes at the beginning of the week and the more advanced, or in some cases the bigger apprentices, attend the latter part of the week. The first effort of the school is directed to the holding of the apprentice to the trade until he becomes accustomed to the environment and imbued with the possibilities which are offered.

Free-hand sketching, mechanical drawing and the reading of drawings are carried out on a scale of completeness commensurate with their use in the shops, the greatest amount of time and energy being placed on the making of free-hand and mechanical sketches to scale on rectangular and isometric coördinate paper. The mechanic must talk with his pencil and the apprentices are all taught to do lots of that kind of talking.

The manufacturers coöperating with the school are enthusiastic in their praises of its work. Instead of a decreasing output for the apprentices who spend four hours per week in school, it is found that in many cases the output has actually increased. The foremen of the shops, where apprentices are employed, have entered into hearty coöperation with the school and its director.

Name of school and location	Year of establishment	Minimum age for entrance	Years in course	Weeks of school in year	Hours of school attendance per wk.	No. of pupils in course
Cincinnati Continuation School, Cincinnati, Ohio	1909	16	4	48	4	250
Franklin Union, Boston, Mass	1909	16	2	24	4	68
David Ranken, Jr. School, St. Louis, Mo	1910	16	2	46	7	30
Mechanics' Institute, Rochester, N. Y	1909	16	3	36	4½	98
State Trade School, Bridgeport, Conn	1910	16	2	35	4	60
Horace Mann School Chicago, Ill	1907	16	4	12	27½	90
James Otis School Chicago, Ill	1907	16	4	12	25	152

TABLE II.—COOPERATIVE PART-TIME SCHOOLS.

CLEVELAND CO-OPERATIVE PART-TIME SCHOOL

The most recent development in co-operative part-time apprenticeship schools is one established jointly by the Cleveland, Ohio, manufacturers and the local Y. M. C. A., Jan. 27, 1912. The purpose of the school is to give instruction to apprentices in the various mechanical establishments of the city in an effort to aid them in becoming skilled mechanics.

The academic studies consist of drawing, blueprint reading and the usual kindred subjects. The class work is to be divided between two groups of apprentices, those who need individual instruction, as separate units, and those whose work can be adapted to instruction in large classes. Already five classes, with about 20 apprentices in each, are in operation. The course covers four years of 40 weeks each year, four hours each week.

An interesting feature of this part-time scheme is that the tuition fee of $20 per year or $80 for the complete course, is paid by the employer, in addition to the payment of regular wages to the apprentices while in school.

Fifteen representative manufacturing establishments have joined in this scheme. An advisory committee of experienced, practical men, who are to have general direction of the experiment, has been chosen from the Cleveland manufacturers.

In Table II are shown the philanthropic, as well as public schools, which have recently offered part-time instruction to apprentices in the respective cities.

The Beginning of the Syracuse Machine-Tool Industry

BY JOHN E. SWEET

The City of Syracuse, N. Y., exists because of the salt springs discovered 150 or more years ago. At first the brine came to the surface of the ground and the salt was recovered by boiling in kettles. Then shafts were sunk and pumps had to be used. This called for the making of pumps. Solar evaporation was adopted, and this called for carpenters to make the vats; pipe-boring machines, and barrel making. The boiling also grew to larger kettles, twenty or more of which were placed in a row. Foundries were built to furnish the pumps, kettles and the pipes, or pump-logs, as they are called, to distribute the brine. Out of these foundries have grown the mechanical industries of the city.

One of the earliest of the foundries was that of Avery & Lines. Mr. Avery of this firm was the inventor of the Avery rotary engine. The buildings have all decayed, and the descendants of all the original founders have died or scattered. Among the present concerns whose antecedents are still remembered, is the firm of C. C. Bradley & Son, makers of the Bradley hammer and carriage fittings.

Christopher Columbus Bradley, born in 1800, in connection with a Mr. Alexander conducted the foundry in a shop near the center of the city. Salt kettles were no doubt a part of their business. In 1855 he moved out of the city and, in connection with W. C. Bradley, Jr., built a shop of wood on land that had been covered with salt vats. They built threshing machines, horse-powers, wheelbarrows, and, as all shops had to do in those days, did jobbing or repair work. The wood building was burned and was replaced with brick.

In the late sixties W. C. Bradley withdrew, and the firm name was then C. C. Bradley & Son. In 1867 W. C. Bradley again joined under the firm name of Bradley & Co. Later, in 1872, after the founder died and the present C. C. Bradley, Jr., was born, they built the first Bradley hammer. In the early nineties the business was for a time run under the name of C. C. Bradley, Jr.; but, after 1906 and since it has been conducted as C. C. Bradley & Son, Inc.

According to *Consular and Trade* reports, 71 tons of asbestos were mined and marketed in the United States in 1890, and 3693 tons in 1910, while in 1911 the consumption in this country had risen to 57,124 tons. The use to which asbestos is applied in the United States is mostly for boiler and steam-pipe covering, steam-gland packing and fireproof cloth, much of which is converted into theater curtains.

Special Tools in a Gas Engine Shop

Editorial Correspondence

A number of home-made attachments in a Missouri shop, including a narrow turret for the lathe for machining crank pins; a broad under-cutting tool for finishing shaft bearings; a set of turning and grooving tools for pistons.

A power-feed attachment applied to a hand screw machine; and a special machine for sawing piston rings.

The Bauer Machine Works Co., of Kansas City, Mo., builds gas and gasoline engines ranging from 1½ to 50 hp. The equipment of the shop for this class of work includes a number of home-made tools and appliances, several of which are shown.

Crankshaft Tools

Two operations on crankshafts are shown in Figs. 1 and 2, the first of these views showing a special vertical turret carried on the cross slide and equipped with four tools for different cuts on the pin.

The method of carrying the shaft between centers by offset fixtures, which give the required throw, needs no description, as the construction of the clamping block on the faceplate is clearly shown.

The turret, it will be noticed, is of thin section to pass freely between the crank webs, and each tool is secured in a slot in the turret face by a setscrew. The four holes for the index pin are formed in the side of the turret and the pin itself passes through the upright on the bracket. The tools carried by the turret turn the pin, face the shoulders and form the fillets.

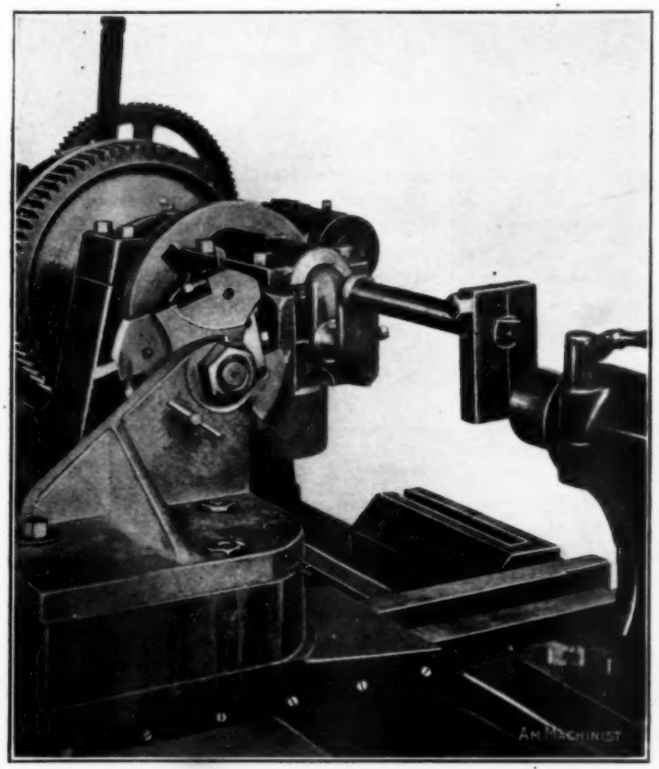


Fig. 1. A Turret for Crankpin Work

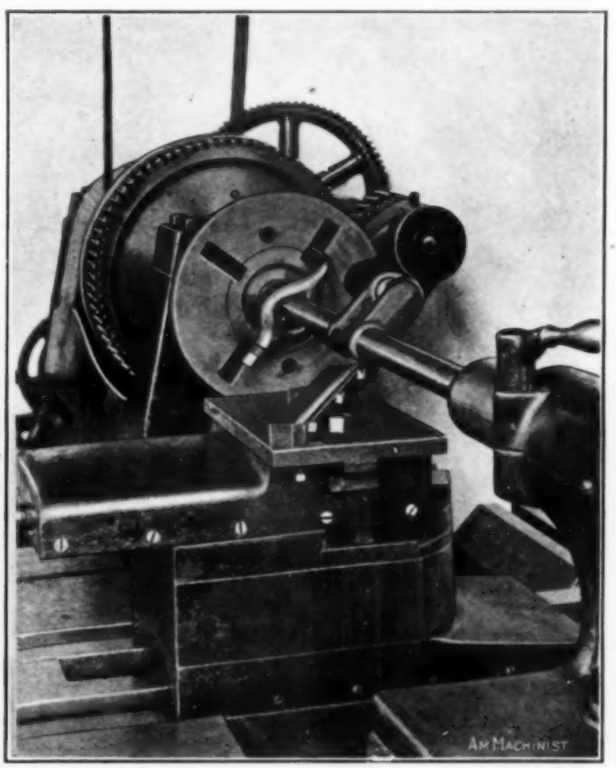


Fig. 2. A Fininshing Tool for Crankshafts

A Finishing Tool for Bearings

The broad-face finishing tool in Fig. 2 works on the principle of the well known brass-finishing tool with its oblique cutting edge which starts operations at one end and passes completely under the work in machining the entire length of the piece.

The tool in this instance is about 10 in. long and is set at an angle of 45 deg. with the centers. It is bolted to the face of a ledge cast across the top of the flat plate on the cross slide and provision is made by means of setscrews underneath for adjusting the tool vertically as it is ground away in the sharpening process. The same screws also permit the tool to be set so that it will cut parallel from end to end.

About 0.002 in. is left on a side in the roughing operation for removal by this finishing tool and a smooth, satisfactory surface is obtained in this manner without difficulty.

Piston Work

A set of piston tools on a special turret attached to a lathe carriage in place of the regular cross slide, is shown in Fig. 3.

There are two turning tools on this turret, one for roughing and one for finishing. Each tool is in the form of a hollow mill with a cast-iron body in which four cutters are inserted at equidistant points about the circumference. For the turning operations the turret is, of course, set central with the lathe spindle. The cross adjustment comes into service when the grooving of the piston is to be accomplished.

The piston-grooving tools are carried in the open holder bolted to the third face of the turret, and the three tools are located in grooves in the clamp by which they are fixed in place. Any desired change in the spacing of the tools is readily effected by changing the clamp. When this open holder is swung into position in front of the piston only a short movement of the crossfeed screw is required to feed the tools in to the proper depth for the grooves.

A Power Feed on a Hand Screw Machine

The hand screw machine in Fig. 4 is shown equipped with a home-made pow-

er feed for the turret slide, which is used on numerous occasions, although readily disconnected when it is desired to operate the turret with the regular hand lever.

At the back of this machine a longitudinal wormshaft is placed, which is driven by a belt from the head spindle, the belt passing over the spindle at a point just outside the rear box. The worm operates a wormwheel *A* and the shaft carrying this wormwheel actuates in turn the gearshaft *B*, whose pinion *C* engages with the rack *D* attached to the turret slide. The wormwheel is connected to its shaft by a clutch which is drawn into engagement by a cam collar at *E*. When this is operated in the reverse direction to release the clutch a compression spring throws the clutch member away from the gear and the turret may then be operated by the hand lever.

The pinion shaft *B* is mounted in an adjustable block and this is set to accommodate different gears for the two shafts, thus permitting the rate of feed to be altered to suit the work in hand.

Ring Sawing Machine

The machine in Fig. 5 was constructed for sawing piston rings. It has a simple spindle carrying two narrow saws, and a cross slide carrying a slanting table upon which the ring to be split is secured by a clamp. The clamp is actuated by means of an eccentric binder shaft and handle.

The feed screw is operated by the crank handle at the front, and two stiff compression springs at the rear act in the opposite direction to take up the back lash and prevent the work from jumping into the saws when the cut is under way.

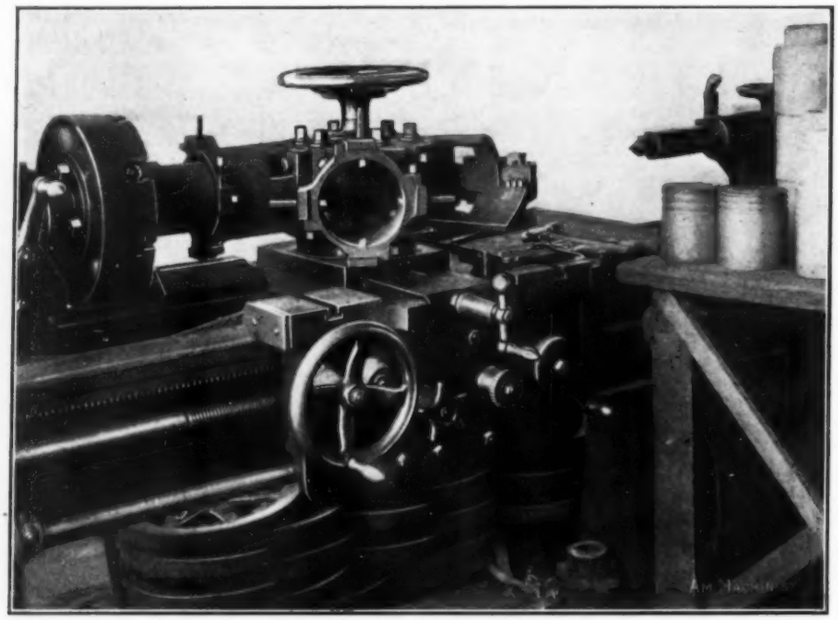


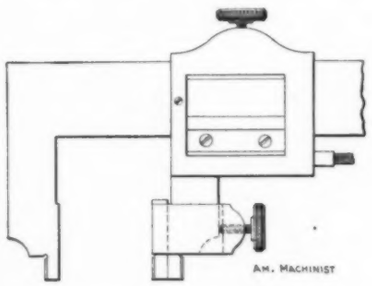
Fig. 3. Special Turret and Piston Tools

A Caliper Attachment

By F. Crooke

The cut shows an attachment made for my Brown & Sharpe 6-in. vernier caliper. It consists of an extra jaw which can be attached to either jaw of the caliper. This extra jaw is ⅛ in. thick, so that when in position, it can be inserted into a ¼-in. hole.

I find the idea very useful in jig boring and similar work, when measuring the distance between the center of a hole



Caliper Attachment

and a straight face. It can often be used where it would otherwise be necessary to turn up a plug, stand the job on a surface plate and measure with a height gage. As the hole being bored can be measured with the same tool, the plug is cut out. Obviously this is a much quicker method, and I have no reason to think it less accurate.

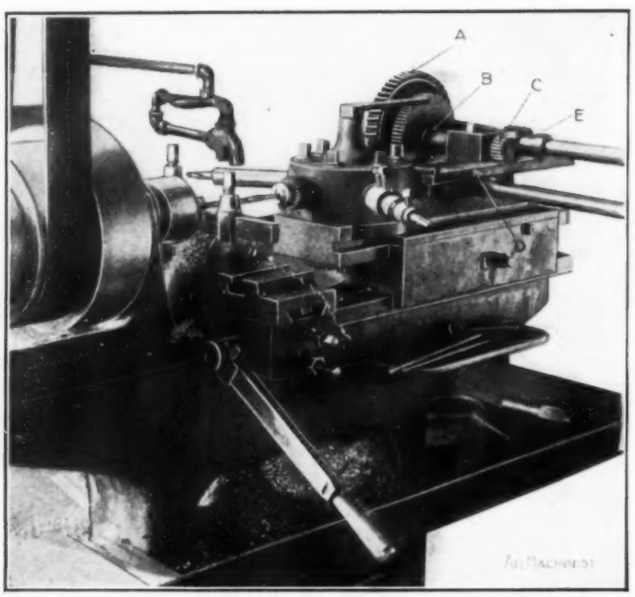


Fig. 4. Power Feed Applied to a Hand Screw Machine

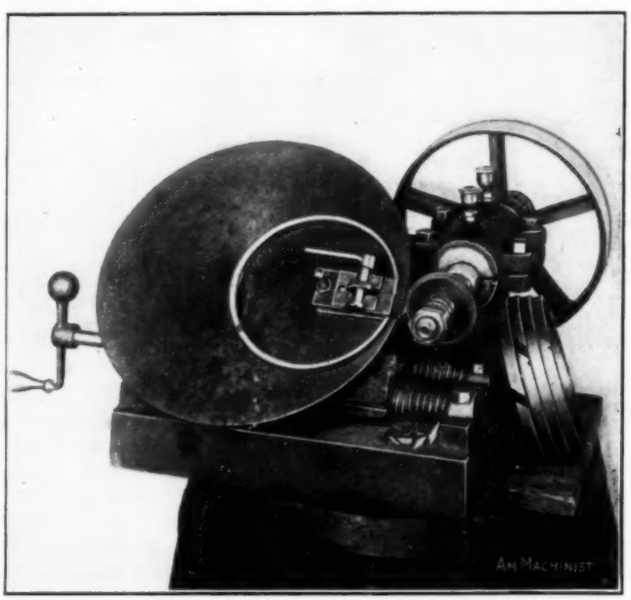


Fig. 5. Piston-ring Sawing Machine

Design of Punch and Shear Clutches

By Entropy

Formulas and factors of design for the diameters, number of teeth, and depth of teeth of punch and shear clutches.

The design of jaw clutches for punches is for the most part a matter of rule of thumb and is characterized by a liberality of proportions that makes such machinery on the whole as satisfactory as can be expected. There is no known safeguard that will prevent some laborer from trying to shear off steel armor plate in a shear intended for soft-steel squares as thick as the plate.

In such a case it is desirable that the belt shall slip before the press is injured. If the same laborer in his zeal tightens up the belt to make it carry the cut it is preferable that the clutch should let go rather than the shaft, and preferable that that should fail to having a cracked frame.

A part of the design lends itself to analysis and for the sake of arousing discussion the design of a shear, or rather the shaft and clutches for a shear intended to cut three-inch rounds will be discussed.

It should be borne in mind that present-day practice is pretty well settled on the use of a square shaft drive with a sliding jaw clutch which is made to engage by the pressure of the operator's foot on a treadle and to release, at or just after the top of the stroke is reached, by some automatic device which prevents a repetition of the stroke until the operator is ready. The design of the shaft is really one of finding the size square which will carry the necessary turning moment to cut 3-inch stock.

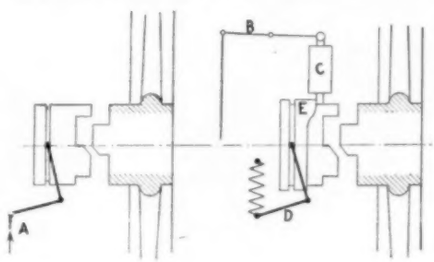


FIG. 1

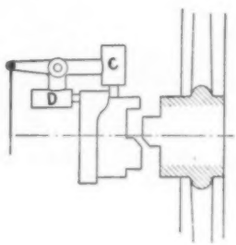


FIG. 2

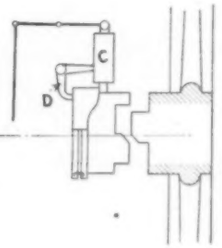


FIG. 3

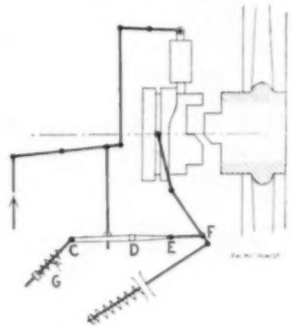


FIG. 4

CLUTCHES FOR PUNCHES AND SHEARS

FIG. 5

SHEARING STOCK

Almost all shears for this size stock are made with a stroke of only 2½ in. A 3-in. bar cut through all but ½ in. is ready to drop off; if it were not it could be slid along a bit and another stroke would sever it. At the beginning of the stroke the pressure is theoretically infinite but the small line of stock on which the pressure comes is so short that only a small pressure is used. The pressure on the clutch jaws is comparatively small.

As the shearing progresses the pressure on the cutter increases and that on the clutch grows rapidly greater until probably at about one-third stroke it becomes maximum. From that point on, the resisting power of the stock being cut grows rapidly less while the crankpin first increases its effective radius until mid-stroke and then decreases it again until the end of the stroke.

It is customary to allow for shearing the full cross-section of the stock at mid-stroke, which is certainly on the safe side. Eighty thousand pounds per square inch is taken as the full shearing strength of the stock which, with an area of practically 7 sq.in. and a radius of crankpin of 1¼ in., gives a turning moment of 700,000 inch pounds. Using the formula for a square shaft and a safe shearing strength of 3000 lb. we get:

$$P \cdot a = 0.236\, D^3 \cdot p_s \qquad D = 10 \text{ in.}$$

The shearing strength of 3000 lb. is justified on the ground that the shaft should be very safe, and that the parts are all subject to continual shock. The body of the shaft has simply to be enough larger to enable the square to be worked out. It is not usual to make the square sharp-cornered, but to make the body about 1.3 as large as the side of the square, which would make ours 13 in.

NUMBER OF TEETH

The number of teeth in the clutch is largely a matter of convenience and depends on the promptness with which it must act. It ranges from 2 to 20, the latter averaging to engage 10 times more promptly than the first. To make the two parts of the clutch of equal strength it is necessary to make them of equal size; therefore if the workmanship is good there will be the same strength to resist shear and crushing on the clutches whether there be few or many teeth.

OUTSIDE DIAMETER OF CLUTCH

This should be such that the pressure on all the teeth will not exceed the safe shearing strength of the material of which they are composed. This area may be taken as half the area between two circles, one the size of the body of the shaft, the other the outside diameter of the clutch. The load should be taken as the pressure at the average radius of these two circles that will give the requisite turning moment. Put in the shape of a formula this reads:

$$P = \frac{\pi (D^2 - d^2)\, p_s}{8}$$

where P is the load, D the outside diameter of the clutch teeth, d the diameter of the body of the shaft and p_s the assumed safe shearing stress which is taken higher than that for the shaft. The arm of the turning moment is

$$\frac{D + d}{4}$$

If we call the turning moment M then we can combine these two equations into

$$M = \frac{\pi p_s}{32} (D^2 - d^2)(D + d)$$

which is easiest solved by trial. If we take p_s at 4500 or 50 per cent. more than we used for the shaft so as to insure the safety of the shaft we find that D should be between 20 and 21 in.

DEPTH OF TEETH

The depth of tooth to be used is more or less an arbitrary matter. It should be deep enough so that the working pressure between teeth will not exceed the safe crushing strength of the material. The uniform distribution of pressure over the entire area of the tooth contact is a matter of better workmanship than is usu-

ally put on these parts. It is, of course, likely to be better with a small number of teeth than with a large number, which has an influence on design.

In our case, however, if we assume only two teeth to carry this pressure, each with a radial length of 4 in., we find that there is very small need of figuring it. The pressure of 87,500 lb. distributed over 8 in. in length, if the teeth were only an inch deep, would give a bearing pressure of 11,000 lb. per sq.in. which, of course, is so low as to render us indifferent as to the exact amount of actual bearing area.

We would hardly wish to make the teeth less than an inch deep as they must hook together sufficiently so that they will not jar loose; 1½ in. is nearer actual practice. It is customary to make the length of the clutch equal to the diameter of the squared part or slightly longer for the sake of the length of bearing on the shaft. This length will be found to produce as much excess strength as the depth assumed for the teeth did.

Clutch-shifting Mechanism

The remaining problem is that of shifting the clutch. For safety and convenience it is customary to make the shear stop automatically at the top of the stroke. Some are made adjustable to stop at the point in the down stroke which is just above the work; this is an advantage in following lines or punching to a layout.

If it were not for the automatic stop, Fig. 1 would represent all that would be necessary. This is a simple bell crank connected by rod *A* to the foot lever by which it is pushed into place. It is withdrawn by a spring attached to the foot lever. It is better, however, to depend on the spring only to engage the clutch and to use a cam to throw it out, as indicated in the following illustrations, of which Fig. 2 is perhaps the simplest.

In this the foot lever is connected to the lever *B* which lifts a plunger *C*. When the plunger *C* is out of the way the spring and bell crank *D* force the clutch into place as soon as the teeth can engage. When the pressure on the foot lever is released the plunger *C* drops down in front of the cam *E* and forces the clutch out at the top of the stroke.

The same principles applied in slightly different ways are shown in Figs. 3 and 4. In Fig. 3 the bell crank is made to carry two spring plungers *C* and *D* which alternately throw the clutch in and out by operating against the cam as in Fig. 2. In Fig. 4 the plunger *C* is the only spring-operated one. The bell crank *D* is operated by means of *C*. This figure shows a T-slot running around the clutch, to which the releasing cam is fastened, so that it can be shifted to change to the time of stopping.

In Fig. 5 is shown a scheme which is the same as Fig. 2, with the addition of a safety device to hold the clutch from slipping out. A continuous lever *C D E* is pivoted at *D*. The spring *G* at all times tends to hold it in the position shown. When in that position the link *E F* is in line with *D E* and holds the bell crank from kicking back. When the loot lever is depressed the end *C* of the lever *C D E* is pressed down and the bell crank can throw in the clutch. This acts as a safety device in case anything happens to prevent the cam or upper plunger from working.

Dust in Shops and Factories

By Robert Grimshaw

This is a question which has never been threshed to the proper conclusion, partly because there is wanting enough good data on the subject of the amount of dust generated in the various branches of industry, and of the kind and amount of harm that it does, and partly because of the active opposition of proprietors and the indifference of law makers and working people to the question of health involved.

Among the diseases caused by the presence of dust are the "dust disease" of the lungs, bronchial and pulmonary catarrh, and paralysis of the lungs. Statistics prove, also, that long continued dust breathing leads to inflammation of the lungs and to pulmonary consumption.

German statistics point a moral. Ollendorff found that in the cutlery districts of Solingen and Lennep, 46 per cent. of all persons over 20 years old, were affected with pulmonary consumption; but among the grinders alone, there were 78 per cent. According to Hirt, of 100 workmen, each in different branches of industry, the proportions of consumpton are: Those inhaling metallic dust, 28 per cent.; mineral, 25.2 per cent.; vegetable, 13 per cent.; animal, 20.8 per cent., and mixed, 22.6 per cent. The reports of the hospitals show that the workmen who breathe irritating dust furnish the greatest proportion of patients.

This is not to assert that all dust is the cause of lung consumption; for we know that coal dust can penetrate and clog the lungs to such an extent as to render them stiff, and can get even in the liver and spleen, without causing inflammation of any of the three organs named. In fact, there are many who assert that coal dust is a good preventive of consumption.

Some kinds of dust are more likely to carry germs than others; some are in other respects especially injurious by reason of their physical constitution or for other reasons. But as far as consumption of the lungs is concerned, most specialists who have studied this question are agreed that metallic dust is the most dangerous, and flour dust the least so.

This seems strange inasmuch as one would expect iron or brass dust less likely to carry such bacilli than the softer flour particles. This in a measure is true, but the sharper metallic particles can cause almost imperceptible wounds of the lung tissue, affording the bacilli a better opportunity to enter and remain. These sharp particles act in the same way as the lancet of the vaccinator, which gives the lymph a chance to get into the circulation. There are, further, many chronic lung diseases which are popularly called "consumption," but are in no respect tuberculosis.

Fine vegetable dust is apt to cause obstinate catarrh. Stone and charcoal dust causes a stiffening and hardening of the lung tissue; then there are the "tobacco lung," and the "cotton lung," and a special variety of pulmonary trouble caused by the Bessemer-Thomas slag used as fertilizer.

Although the lungs offer dust the best chance to annoy and injure the human organization, our outer skin may readily, if only slightly scratched, harbor dust which is laden with bacilli, or the dust itself may be sharp enough to effect a lodging for itself and the bacilli which it carries. There may ensue as a result various kinds of skin disease, or even general blood poisoning.

For such shops and factories as have wooden floors, various kinds of oil have been proposed and used, tending to "bind" the dust, much as tar has been used to bind the road surface in these days of automobiles. Holding the dust all day and sweeping it out by night is not the correct principle. Dust should be removed as fast as generated, in many cases made harmless by being discharged into water to facilitate its being handled in further removal.

Dr. K. Zibell shows that the harder and sharper the dust particles, the more dangerous they are, other things being equal. On this account he recommends wet grinding, and as far as possible the use of water in other industrial processes.

Dust-catching masks are in some cases desirable, as for instance in breaking stone in the open, where the use of exhausters would be out of the question. Eating in workrooms should be forbidden; plenty of good drinking water should be furnished.

Zibell thinks that in industries where much dust is developed no males under 16 and no females under 18 years should be employed. This would be hard to carry out and is perhaps not desirable. That the lungs of all working people should be examined before being permitted to follow dusty occupations is perhaps not so unreasonable.

The Human Factor in Manufacturing

By James Hartness*

Study of the effect of habit and inertia on the worker and on manufacturing in general.

Getting men in the place for which they are best adapted of more value than mere systems, which should be only a means to an end.

*President, Jones & Lamson Machine Co.

Note—This article has been abstracted from advance page proofs of Mr. Hartness' book entitled "The Human Factor in Industrial Management."

In the industrial world we are confronted by the instability of things. There is a fluctuation in the fortune of each industry, each organization and, unfortunately, of each mortal. We know of no plan than can infallibly control either the ebb or flow of fortune.

There are men who have been uniformly successful in all of the undertakings in which they have engaged, but whether they can give to others their plan or not, we know that they never do. It is doubtful if any complete scheme can be formulated, the variants and the combinations are so new and so numerous.

Perhaps we should not insist on the explorer telling us how he got there. His business is to get there. He may have taken instructions from someone who never did and never could get there, or he may have made his own plan, but in either case his success was doubtless due to the way he carried out the plan. In other words, his success was the outcome of either his own methods or his own interpretation of another's scheme, so that there is no prospect of our being able to sail by rule.

The industrial sea is not fully charted. There is still a need for the navigator to sail "guess and lead" and "luck and log." The hardest workers and the most strenuous thinkers seem to be as unfortunate as those who take life less seriously.

But, while these facts are true, it is not unreasonable to believe that we are truly progressing toward a better control of the economic condition. For, great as has been the increase in intricacy of business relations and the complication of mechanical devices, there has also been a marked advance along lines of analysis of economic elements, with a tabulation and deduction that have brought much of the industrial problems within the reach of the ordinary mind. This advance has not been made any too soon. In fact, it has been tardy in arriving, but it is now here and is being carried forward by some of the best industrialists in the land.

The Purpose of Systems

It must not be thought, however, that analysis, tabulation, and simple deduction are the beginning and end of industrial science. They are only the scheme for coördinating the various forces. They are so purely statistical that they must not be mistaken for a major means, but rather a minor means for coördinating the principal means. They tend to give a wholesome counterbalance for an over-visionary scheme of management, but in their function of coordinating all other forces, they must be subjected to whatever modification is necessary to make them fit into and use the real forces.

In trying to solve the problems we naturally turn to observing all kinds of organizations. We find that they all bear evidence of imperfection.

There may be either an indifference to the appeals of the advocate of this or that system of betterment, or a tendency to follow some one branch of improvement with more or less neglect of other opportunities. The neglect is not due to an actual undervaluation of the importance of the other elements, but because the enthusiasm over one element robs the others of the force that is necessary to carry them forward.

The mere mental acceptance of the true valuation of each of the other elements does not bring any real valuable help. The enthusiastic push of some one mortal is necessary back of each scheme of betterment.

This should be facilitated by a subdivision of the duties of management. The head control, however, should try to keep a general view of the whole and see to it that there is a harmonious pull of all of these forces.

Just now we have many who have taken a strong interest in "Scientific Management." This system improves the efficiency of an organization by giving to each worker a thorough direction for the performance of his duties.

Among other features it keeps an accurate record of the time required to perform each operation, and uses this as a basis for estimating the time required to perform other similar, or nearly similar, operations. It is a methodical scheme of intelligent direction of work, and it depends for its success more on correct direction of operation than on the workman's natural ability and inclination to devise his own methods.

This is not set forth as an accurate statement of "Scientific Management," but it is in brief an impression that has been gained by observation and study of this most valuable plan. The system doubtless is intended to include the use of every means for progress, but in practice it seems to lay emphasis on the best use of the present means, rather than the invention of new and wonderful machinery.

"The best use of the present means" is a policy that should be given first place in all schemes of industrial management. It is the most economically sound principle that can be set forth. It meets the present needs. It is not a barrier to progress by invention, and if intelligently carried forward it need not run violently against the force of habit of the workers.

If the present use is not as efficient as it should be, the "Scientific Management" plan provides for a direction of the workers along other modes of use. It usually makes slight changes in the means, but it gains its greatest results by giving the workers instructions that help them to make more efficient use of their energies and the present means. The reason that it has not had more universal success is doubtless due to the inertia of habit of both the workers and the management, and it is to this phase that the present discussion aims to direct attention.

Human Welfare and Industrial Success

The plan that gains the greatest real benefit to each mortal is the one that in turn brings the greatest success to each industry and nation, and, if it is universally applied, to the world in general.

The line of action should be one that takes into consideration the inertia of the human being, as to habit of both thought and action. There should be a constant effort to improve conditions, but the progressive work should be prosecuted in keeping with the laws of inertia.

It should be an effort of the intelligent kind, one that takes into consideration that man is not an unthinking creature: that all men are not equally sensitive to suggestion; that all men are not born to rule or to dream of lofty schemes. It should recognize that some are happiest with a wholesome kind of work—work that gives their bodies the needed exercise and is sufficiently fatiguing to bring on a desire to go home and get the pleasure of rest; that some are happier at clerical work; that others find their greatest pleasure in the skillful control of a machine or instrument, while still others gain most in the study of intricate mechanism.

All of these should be equally considered. And last but not least, the greatest thought should be given for the man who does not spend much time in trying to solve all the problems, but who, nevertheless, is the most important element to consider as he represents the

greatest number of men. He is the one for whom the thinkers should think, and when they think for him they should not think that he thinks as they think. He does not think that way at all. His view is from another standpoint. It may be a truer view of the real world; surely it is the one held by the greatest number.

The welfare of all men, from the Napoleons of industry to the newest recruit into the work, should be so considered that each man should have the best work for which his endowment and general characteristics fit him.

We lift up a man when we take a worker whose greatest achievement has been to inefficiently handle a shovel and by patience teach him to do a better work; one by which he creates more value, and one in which he can obtain a better wage for himself and family. If his brain is not made to guide a nation, this work may not be so degrading as it seems. The work for each should be the highest type available for him. One of the greatest crimes against this or any other mortal is to make him discontented with his natural place in this world.

Building on Habit

The natural and most efficient scheme of conducting business is to build on habit. We see evidences of this on every hand. The specialist is superior to the "Jack of all trades." This fact has been known for centuries, but never before have conditions existed which have so forcefully demonstrated it. It applies to the business and commercial side of the industries as much as it does to the manufacturing side.

The skill of the workman is due to his continual application to his own particular work. A lathe hand cannot turn out his best day's work without his own lathe and his own tools, his own bench and work and general surroundings. Give him another lathe of even the same make, and it may be days before he attains his previous record. Change his work frequently, and you have reduced his output. This condition goes through all kinds of work in manufactory and office.

There are two general objections to the ultra-specialization plan. One is wholly commercial and the other is wholly humanitarian. The commercial view seems to show that specialization involves a high cost of selling, and that it is impossible to obtain a sufficient volume of one kind of work to make it practicable, and the humanitarian thinks that it degrades the worker to restrict the range of his operations. Neither of these views takes in the whole subject, and either one may lead to an erroneous conclusion.

We will devote most of our space to discussing the practical and economic side of the question. But since the mind naturally shrinks from any conclusion that is not humanitarian, let us first clear away the fallacy that specialization in itself is degrading to the workers.

Unfavorable Conditions Must Be Changed

We know that hard physical labor does not produce the clearest mentality; that over-strenuous manual effort seems to lower the perceptive powers; that even monotonous light work is a real drudgery, whether it is the use of a pen or of light instruments, and that all such work may be detrimental to the mind, either by hindering its development or by actually dampening its ambition. Furthermore, nerve-racking environment may be detrimental to both mind and body.

These and many other conditions exist and are most unfortunate, but there has never been a time when there was less of the adverse conditions, and it is probable that the natural evolution of things will reduce many of these. These conditions are not necessarily an accompaniment of specialization. They are only the temporary maladjustment that has always accompanied human progress.

There is a way to greatly minimize these unfortunate conditions that is not against the interest of the business or the individuals in it. And this is the only way that we should take. It only involves the use of our brains in seeing to it that each man's work in the world is the best that is available for him. And that when he is in that position, see to it that he is given every facility for improvement of which he is capable.

In many cases the position toward which an extra ambition might push men would render them, by its exaction of strenuous work and worry, wholly unfit to lead a comfortable existence. Many a worker who at some time has had responsibilities thrust upon him knows that the real "peace of mind that is dearer than all" takes flight when the burden of responsibility is taken on. Such workers have found that study at home in the evening is not to be enjoyed by a man who comes home with a brain already tired out by the duties of the day.

Such contentment is not understood by one who is built by nature to thrive in an environment of responsibility. He thinks this contented fellowman is lazy. He does not know that there is little or no laziness in this world of the kind that that term usually implies.

Both the so called lazy and energetic are alike following nature's law. The former may need an extra stimulation or force of circumstances to induce him to take the amount of work and exercise that is best for his mind and body, while the over-energetic man may require a treatment of an extremely different kind in order to hold him down to the greatest performance of which he is capable without loss of mental poise. Both extremes are on the earth, and there should be a way by which each might be placed where his peculiar characteristics will render the best results to himself.

Fitting the Pegs to the Holes

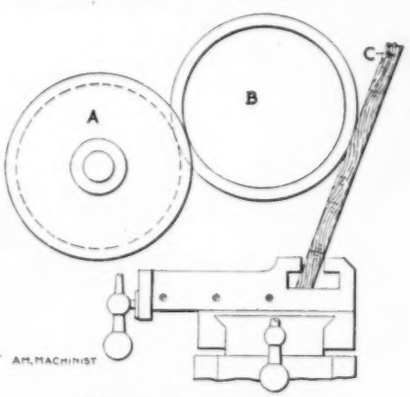
In the industrial world all kinds of mortals should find their natural places. And with the natural evolution which will doubtless soon force the human mind to take up this problem of proper position for each mortal, there will be a great improvement in the conditions of the worker in the industrial establishment. But it is needless to hope to attain anything like contentment and comfort as long as there is an irrational raving about the debasing effect of industrial work. The most ordinary operations may be performed by men who are not qualified to do better work and who without this work would be idle.

In the same way, all of the various positions in an industrial establishment should be filled. In each position there should be a man who is in the best place in the world, for him.

Fitting Piston Rings

By J. Wexler

In most shops, to my knowledge, a good piston-ring fit is obtained by scraping the ring in. This takes quite a lot of time, especially when the rings are a little full on the sides. My way does not apply to a shop properly equipped and making a specialty of piston rings, but rather to jobbing and repair shops, where



Fitting Piston Rings

time counts and everything has to be done in the quickest and best way.

Whenever I have a ring that fits a little tight on the sides, it takes me only a few minutes to obtain a fairly good working fit by grinding it in as shown. I put the piston rod, with the piston *A* on it, in the lathe between centers, take out the tool post and insert a piece of wood *C*, about 2 in. wide instead, stick the ring *C* in the piston, with the opposite side resting against the wood, put plenty of oil on it, start the lathe up and sprinkle a generous supply of fine emery on it and let it run that way a few minuates, and the job is done.

An Unusual Shaft Welding Job

By H. R. Setz*

After all other expedients had been rejected a large gas-engine crankshaft was built up by the oxyacetylene welding process and a substantial saving in time and money effected.

*Chief engineer, Struthers-Wells Co., Warren, Penn.

The adaptability of the oxyacetylene welding process to extraordinary cases was demonstrated recently at the shops of the Struthers-Wells Co., at Warren, Penn. The generator end of a crankshaft for a 600-hp. vertical, four-cylinder gas engine had be turned and finished, as shown in Fig. 1; the hub of the generator to be used was to have two bores, 13¾ and 14 in., respectively; the former to be a force fit.

It developed after the shaft was finished that a different generator, the hub of which was bored out 14 in. straight through, had to be used. The variation of ¼ in. between the shaft diameter and the bore in the generator was discovered when the latter was ready to be pressed on the shaft, and steps had, therefore, to be taken to overcome the discrepancy.

Bushing the generator armature so as to make it fit the shaft was out of the question, since an absolutely tight fit was required. Even if the difficulty of making and securing to the armature a bushing of 14-in. outside diameter and only ⅛-in. wall thickness could have been overcome, the keyway which would have cut through the bushing, prevented such a method or procedure.

A new shaft, weighing about 18,000 lb., would have cost in the neighborhood of $3000, so this idea was speedily abandoned. For the same reason, the idea of replacing the generator armature did not find much favor.

Finally it was decided to build the shaft up by the oxyacetylene welding process, by means of which enough stock could be added to turn the shaft to the dimensions shown in Fig. 2. After the shaft had been supported on heavy V-blocks, so that it could easily be turned around, the first step was to equally heat the shaft end to be welded by means of an ordinary oil torch. (For several days previous, the shaft had been lying in an open shed, exposed to zero temperature.) This operation took about two hours, after which the actual welding was started. An idea of how this was done may be obtained from Fig. 3.

On opposite places two welders started to build up a strip about 3 in. wide, which was gradually worked toward the top until the upper half of this strip was complete. The shaft was then turned around and the lower half built up likewise. In a similar manner this was repeated, adding every time a strip about 3 in. wide, down to the bearing part 10 in. in diameter.

At first it was intended not to touch this part at all. As the work proceeded, however, it was thought advisable to build up this end of the shaft also, so that, should the welding on the heavier portion have produced any distortions, this could be eliminated on the lathe.

In order to prevent the shaft from cooling, the whole welding job was continued day and night without interruption, the time required being 75 hours. The area to be covered was 2280 sq.in., while the contents of the material added to the finished shaft figured 488 cu.in. In this work, 9700 cu.ft. of oxygen were consumed. The cost of the whole welding job, including material, labor and burden was $383.50, thus causing an expenditure of 16.8c. per sq.in. of surface covered, and 78.6c. per cu.in. of material added. Fig. 4 shows the appearance of the shaft after the welding was completed.

When put on the lathe, it developed that the shaft end was out of true almost ⅜ in. This could easily be determined by means of a false center put into the tapped hole in the end of the

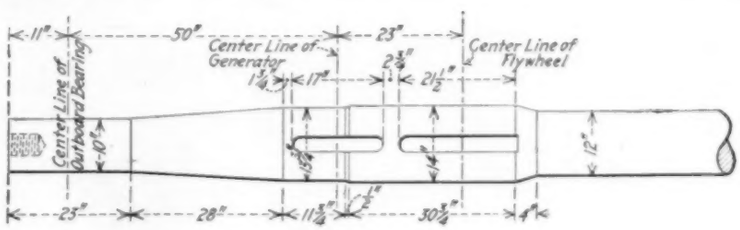


Fig. 1

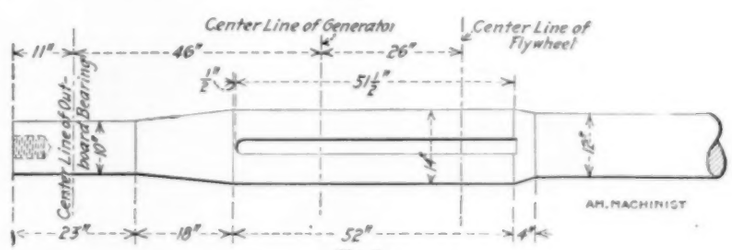


Fig. 2

THE CHANGES IN DIMENSIONS

FIG. 4. THE SHAFT AFTER WELDING

FIG. 3. THE WELDING OPERATION

shaft; the precaution to build up the bearing part of the shaft was, therefore, well rewarded. After a roughing cut had been taken, the shaft was placed on a planer to cut the keyway. Before taking the finishing cut, the trueness of the shaft center was once more verified.

FIG. 5. AFTER THE FINISHING CUT HAD BEEN TAKEN

A view of the shaft, still on the lathe, after the finishing cut had been taken, is given in Fig. 5. The unavoidable small surface flaws characteristic of a job of this nature are plainly shown; in fact, they appear to be more prominent, especially on the tapered part, than what they really were, owing undoubtedly to light reflexes (the picture was taken at night).

The whole job, from the time that the shaft was taken into the welding department until it left the lathe, ready to be put into the engine, took less than seven days, the actual expenditure on work done amounting to slightly less than $600.

A Double-Pointed Screw-cutting Tool for the Lathe

BY WALTER HEAP

In cutting V-thread screws in the lathe with a single-pointed tool, it is necessary to move the tool slightly sideways, so that the cut will be on one side of the thread only. This is to avoid the tendency of the work to "pull" the tool in, which exists when the tool is cutting at both sides at the same time. There is also the danger of the thread being made too thin if the operator is not careful, i.e., the space will be wider than the thread.

All this can be avoided by using the double-pointed chasing tool here described. A single-pointed tool cutting on both sides makes *one double* chip from the two sides, but the double-pointed tool makes *two single* chips from the two sides of the thread, and therefore is not "pulled" like the single point with a chip down each angle of the tool, which often breaks the point off.

This chasing tool is made of two disks 2 in. in diameter, $\frac{5}{16}$ in. thick and having a $\frac{3}{4}$-in. round hole in the center, into which is cut a keyway $\frac{3}{16}$ in. wide and $\frac{1}{8}$ in. deep. Between these two disks is a third plain disk, $1\frac{3}{4}$ in. in diameter, the thickness of which is equal to the thickness or pitch of the thread. These disks are mounted on a $\frac{3}{4}$-in. stud and screwed against the stud collar with a nut. This stud is fixed in the side and at the end of a bar, $1\frac{1}{2}$x1 in., and about 9 in. long.

The nut securing the stud to the bar is on that side next to the loose headstock. The bottom and top edges of the bar are slightly rounded to allow setting the tool to the angle or "rake" of the thread to be cut. The complete tool is held in the tool post or rest in the usual way with plates or setscrews. Plates are best, as with them there is no difficulty in getting the bar to remain in position when being screwed up tight, as setscrew ends have a way of moving the tool when being tightened.

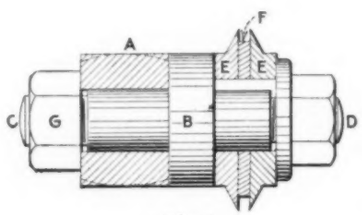


Fig. 1

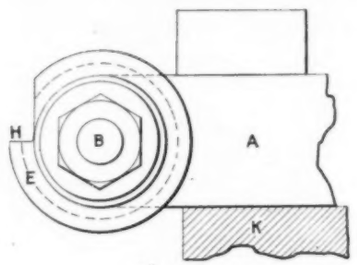


Fig. 2

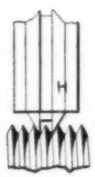


Fig. 3

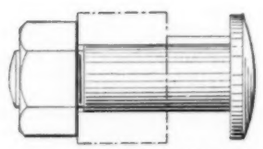


Fig. 4

DOUBLE-POINTED SCREW-CUTTING TOOL

When the peripheries of the two outside disks are being turned to shape, they must be screwed against the collar of the special mandrel, which has a fast key like the stud, upon which the disks will fit when at work. Thus the two disks become one disk, beveled on each side to the exact form of the thread, the point of which coincides with the division of the two disks. When removed from the mandrel, each disk is just half a thread, but before they are removed, the grinding notch or cutting point must be milled in.

To complete the double-pointed tool, the plain disk mentioned is placed between the two beveled disks, and all screwed tightly together, thus making a tool which will cut on both sides of the thread at the same time, doing away with the necessity of moving the tool sideways. Instead there appears a complete thread between the two beveled disks.

A front elevation in section is shown in Fig. 1. Fig. 2 is a side elevation of the general arrangement of the tool for cutting eight threads per inch. Fig. 3 is an enlarged part plan, showing the double-pointed tool in a full thread with the "apparent" thread between. *A* is the bar or tool holder, $1\frac{1}{2}$x1 in., with the top and bottom rounded as at *A*, Fig. 1, and is fixed in the tool rest *K*, Fig. 2. *B* is the stud through the end of *A* for carrying the disks; the end *C* being $\frac{5}{8}$ in. in diameter, screwed 16 threads per inch, and end *D* is $\frac{1}{2}$ in. in diameter, screwed 18 threads per inch.

Fine threads are used to reduce the tendency of the nuts to work loose. *EE* are the two disks or tools (*H* is the grinding notch) and *F* is the packing disk $\frac{1}{8}$ in. thick for a pitch of screw having eight threads per inch.* The above principle may be carried out with two straight tools and a straight packing piece between and fastened together with bolts or setscrews.

With a tool of this description, more and better screw cutting can be done in a given time than with the ordinary chasing tool, because the tool can be set right, as the point is all right, and as soon as the point of the thread appears, the job is right and the spaces are equal to the threads. When cutting square threads with a tool of this order, the cutting points will be a few thousandths wider than half the space. If a stud, as shown in Fig. 4, is used, instead of the stud *B*, Fig. 1, the length *C D* will be shortened 1 inch. This will enable the tool to be used in many places where room is limited.

*The center in the loose headstock center bar must be long enough to clear the center bar of the nut G.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Cutting Spirals on a Planer

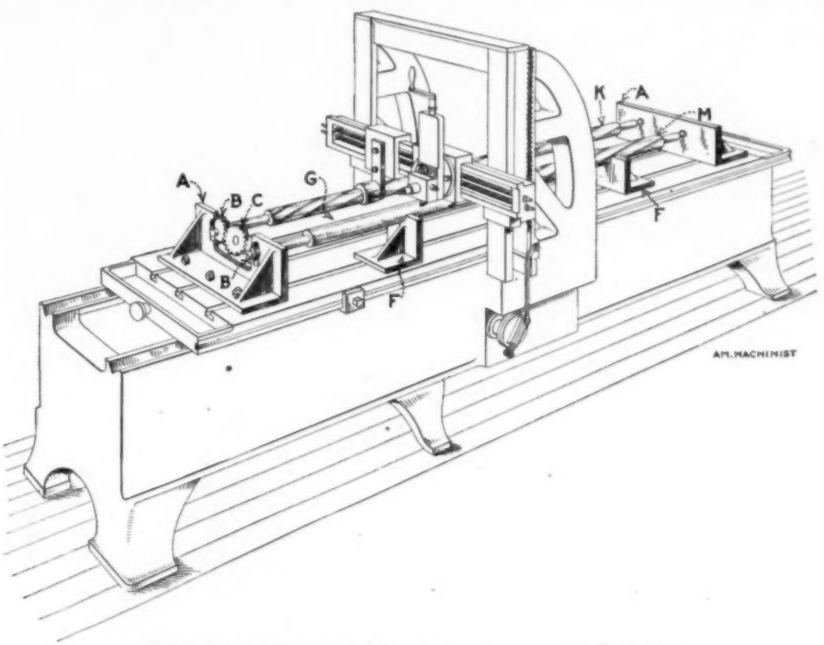
A friend, who is connected with a general repair shop, handed me the sketch of a job that had been rejected by another firm, to which it had been sent for an estimate, remarking that this was the third firm to refuse the job, which consisted of four right- and left-hand spiral shafts, 4½ in. in diameter, 10 ft. long and having four grooves, the lead being 1 in 48 inches.

I suggested that he go ahead and turn the shafts, and I would make arrangements for cutting the spiral later, as I wanted to make up a few sketches for the job. The illustration clearly shows how the work was accomplished. Referring to it, *AA* are two angle plates, drilled and slotted for four special centers, on which the shafts *K* and *M* revolve, the slots being made long enough to allow for height adjustment of the centers. The bottoms were planed with tongues, which lined them up with the platen of the machine.

Two gears, keyed on the ends of the shafts for transmitting the motion from one shaft to the other, are shown at *BB*. An intermediate gear is used for giving the correct rotation. Now two steady supports for shafts are seen at *FF; G* is a bracket and nut taken from the machine in which the spiral shafts worked, and bolted on the head of the planer. One of the old left-hand spiral shafts *K* is used for the master. When cutting the right-hand spirals, the intermediate gear *C* was taken out and two large gears placed on so as to mesh direct. The new spiral being cut is seen at *M*. The work was finished in good time, making a first-class job.

EDWARD J. JENKINS.

Newark, N. J.



DEVICE FOR CUTTING SPIRAL GEARS ON THE PLANER

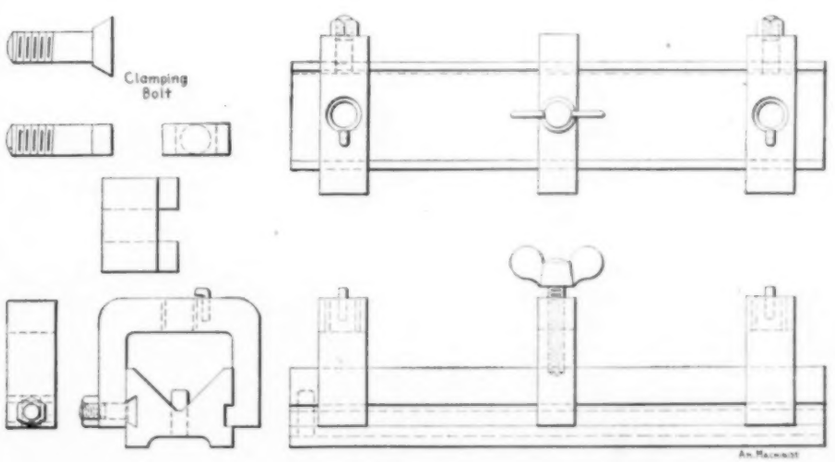
A Shaft or Pin-Drilling Jig

The illustration shows a V-block 12 in. long (longer if necessary) with a groove $\frac{3}{16}$x½ in. on one side, and also a dovetail groove ¼ in. deep with a half-inch opening on the other side. The dovetail groove is used for clamping the stud, which holds the U-shaped pieces in place. The other groove is used as a guide. There are three U-shaped pieces, known as "bridges." These bridges are machined to a nice fit on the sides of the V-block. One side of the U-shaped bridge has a key to fit the square groove, the other is drilled for the clamping stud.

Two of these bridges are drilled central over the V and contain hardened bushings, which in turn receive the slip bushings. These slip bushings are drilled for the various size drills to be used and are made in pairs, hardened and ground. They are held in place by giving a half turn, the bushing having a small slot ground in the shoulder to pass the pin, which is located close to the slip bushing hole in the bridge, as shown in the end view.

The third bridge is drilled and tapped for a thumb-screw and is located between the other two and the thumb-screw used for holding the work from moving while drilling. At one end of the V-block is located a stationary pin used as a stop for the work.

To use the jig, take the pin or shaft to be drilled, place it in the V-block, one end against the stop pin; set the two outside bridges the proper distance apart for the holes, clamp the work with the



A SHAFT OR PIN-DRILLING JIG

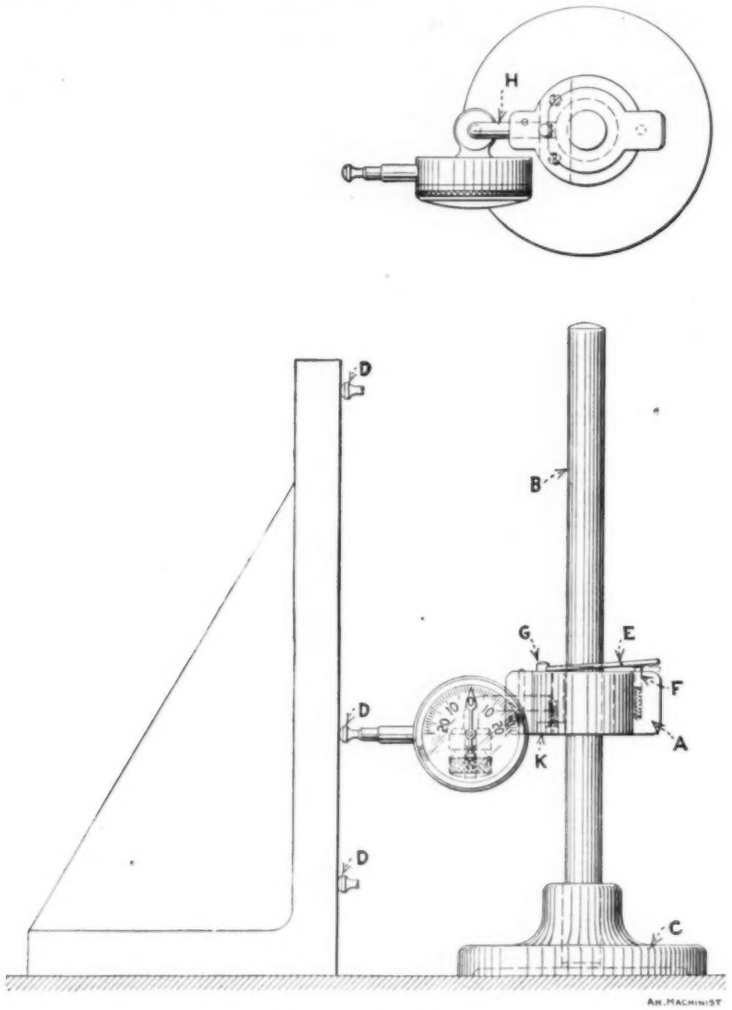
thumb-screw, slip in the bushing containing the size hole to be drilled, and proceed with the drilling.

This jig being open is easy to put work in and take out, and is also easily cleaned. It can be made light or heavy, according to requirements. It will drill any and all pins or bolts, etc., and in case a new design is made with extra pins or changing location of holes it will not be necessary to make a new jig.

Chicago, Ill. H. R. SEYMOUR.

A Useful Square

The principal feature of the square shown in the cut is that with it one can determine at what point the work is out of plumb, and also tell to what extent.



A USEFUL SQUARE

Suppose we want to test an angle plate. Place the angle plate on a surface plate and set the square beside it. Slide *A* down as far as it will go and move the square toward the angle plate until the button *D* of the dial indicator comes in contact with the angle plate, registering 0.010 in. on the dial. Holding the base firmly, slide *A* to the top of the spindle; now look at the indicator, and if the hand shows 0.010 in., the angle plate must be O.K., provided the surface of the angle plate is straight. To ascertain this, slide *A* down slowly as far as it will go, keeping an eye on the indicator, and see whether the hand moves or not. Any untruth will show at once.

The base *C* of this square is made of cast iron, recessed at the bottom as shown, and has a $\frac{5}{8}$-in. hole bored and reamed for a light drive fit. The spindle *B* is $10\frac{3}{8}$ in. long and is made of a good grade of tool steel, hardened, ground and lapped to 0.625 in. in diameter. A flat is ground on one side parallel to the axis and running the whole length above the base.

The slide *A* is made of cast iron and contains a tool-steel bushing, which is hardened, ground and lapped, to insure a nice, easy sliding fit on the spindle *B*. One side of the bushing is cut away to accommodate a key *K*, which is made of tool steel, hardened and ground and held in position by two No. 6-32 fillister-head screws.

This key is necessary to keep the slide *A* from turning on the spindle. This method is much better than to have a spline running the whole length of the sliding surface of the spindle, as is often done.

The stem *H* is made of $\frac{1}{4}$-in. bessemer rod, bent as shown, is turned down to $\frac{3}{16}$ in. in diameter, and threaded for a thumb-nut to clamp the indicator.

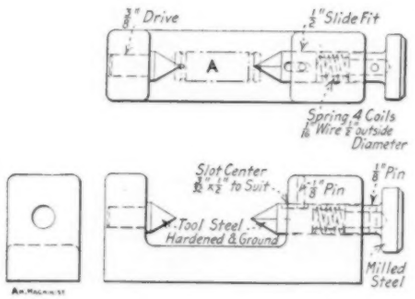
The brake *E* is made of $\frac{1}{16}$-in. hard, sheet brass, and is provided to prevent the slide *A* from falling. By pressing on *E* and bringing it parallel to the surface of *A*, as shown by the dotted lines, one can easily slide *A* up or down the spindle; when released, the plunger *F*, backed by a coiled spring, causes *E* to clamp the slide on the spindle; *E* is held in place by the anchor pin *G*.

Frankfort, N. Y. O. F. GREGORY.

Square Centering Fixture

The fixture here described overcame in a very simple manner, one of those seemingly easy propositions in a machine shop that often develop some difficulties.

The piece to be made is shown at *A*. It is a machine-steel pin turned with two small grooves, one near each end, the pin being $\frac{1}{2}$ in. in diameter and $1\frac{1}{2}$ in. long. After turning and leaving 0.00075 in. oversize, it was heat treated and then ground to size, the grinding being done all over the pin.



A SQUARE-CENTERING FIXTURE

The turning of the pin would not ordinarily have been a difficult job if done on an automatic machine, but even then the grinding of the pin was the seat of difficulty.

Bars were cut to size by hand; the pieces were then centered on one end only, and the fixture shown was placed between the jaws of an ordinary bench vise. The centered end was then placed on the round center of the fixture and the square center brought to the exact center of the other end, and given a tap on the knob attached to the square center. This gave us a square centered pin.

We also used, in the live headstock of the lathe and grinder, a square center, fitting in the square end of the pin made by the fixture. By this method, we were able to do the small amount of turning, and more important still, the entire grind-

ing of the pin. The live center of the pin being square, and fitting in the square of the pin, acted as a driver, obviating the use of a driving dog or catch.

The economy of this method is apparent, as the use of a driving dog for either operation would have made it necessary to take two cuts and change the dog after each cut.

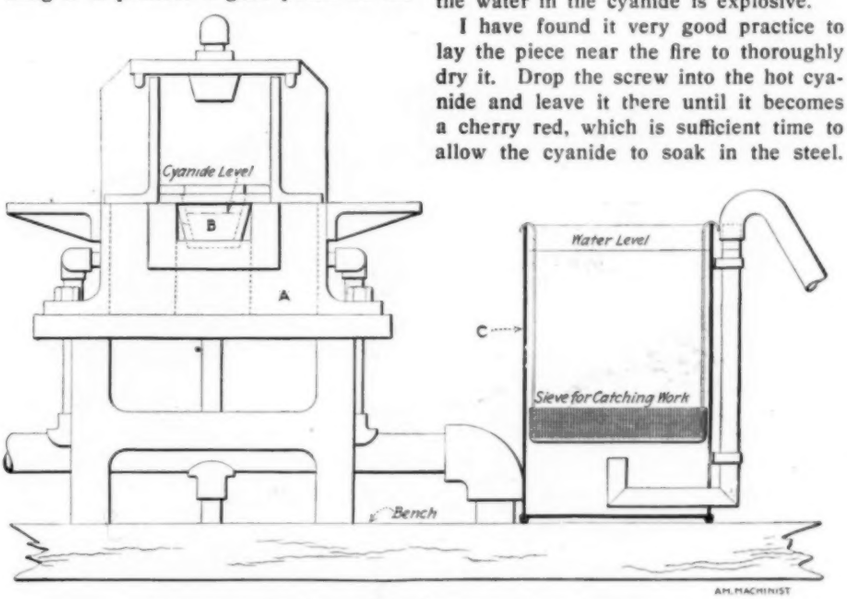
The line engraving practically explains itself. The body is a simple shop forging; the spring at the square center end, in tension, brings the center against the pin to be centered and a slight blow on the knob centers it. The bench-vise jaws rigidly hold the fixture in place, and it is as easily handled by a boy as a man.

ROBERT MAWSON.

Providence, R. I.

Mottled Case-Hardening

Not long ago I noticed in these columns an article relative to mottling, (commonly called fancy case-hardening). It might interest readers to learn the method I use in getting the same results on small parts, such as screws, dowel pins, etc. The secret of the whole thing is to produce a good polish on the surface to be mottled, removing every line that can be seen with the naked eye.



APPARATUS FOR PRODUCING MOTTLED CASE-HARDENING

Provided you have an open gas furnace, as shown at *A*, procure a cast-iron pot *B* that will fit between the two lower firebricks of the furnace. This pot should be provided with a cover to prevent the flames from coming in direct contact with the cyanide. Such a lid also prevents the escape of the fumes. It is cut out sufficiently to allow the insertion of screws, etc. Of course, if larger pieces are to be mottled, use a larger furnace and increase the pot, etc., in proportion.

The next essential is a can about the shape and size of *C*. This should be provided with a spout extending through the side at the bottom to about the center, and then elbowed as shown. To this spout attach a rubber pipe, which in turn is connected with the compressed air.

When the can is full of water and the air is turned on a trifle, the effect is the same as a natural spring bubbling from the ground. Add to the water about as much nitrate of potassium (saltpeter) as the palm of the hand will contain. The water should be about 70 deg. F. to begin with. Place enough cyanide in the pot, and when melted, fill the pot about three-fourths. Next bring the cyanide to a cherry red and adjust the gas and air valves on the furnace so as to retain the cherry heat. Don't get the cyanide too hot, as it will only burn up and fill the room with a poisonous odor.

Assuming that the mottled effect is to be produced on the head of a screw, a loop is first made of soft wire and the screw slipped into it. The head of the screw surface should be as smooth and free from oil as possible. Be exceedingly careful not to have the minutest particle of moisture in the threads or anywhere on the screw, as the action of the water in the cyanide is explosive.

I have found it very good practice to lay the piece near the fire to thoroughly dry it. Drop the screw into the hot cyanide and leave it there until it becomes a cherry red, which is sufficient time to allow the cyanide to soak in the steel. Then take the screw out and immerse it in water as quickly as possible. The results will be astonishing.

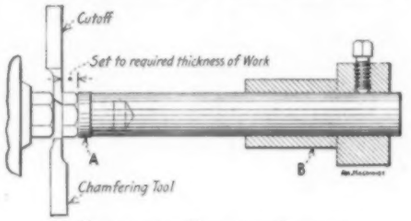
I had some small pieces to be mottled and made the necessary preparations to produce this effect, when in some way a little water got on one of the pieces, which when dropped into the cyanide, resulted in a terrible "bang" and the first thing I knew my face and arms began to smart. There is a warning in this experience to be very careful in handling hot cyanide. After you have done the mottling set the pot in some obscure spot to cool.

Frankfort, N. Y. GEO. F. OLIVER.

A Stop for Turret Cutoff

The illustration shows an accurate and reliable "stop" for use on a turret lathe on bar work, and where the cutoff tool is carried on the revolving turret. It consists of a bar to fit the tool holder opposite the cutoff slide, and made easy of adjustment in the holder.

The opposite end is bored and reamed a running fit for the piece *A*, which is free to rotate. The bearing surfaces are case-hardened, the whole being made of cold-rolled steel.



A STOP FOR TURRET CUTOFF

In use the stop is adjusted in the holder *B* at the right distance from the right-hand side of the cutoff tool. No other stop of any kind is now required and the number of pieces to be cut off with one chucking of the stock is only limited by the length of each piece and the distance it is advisable to allow the stock to project from the collet.

The device will pay for itself in two hours in time saved and accuracy gained.

PAUL CAMPBELL.

Cleveland, Ohio.

Dimensions on Drawings

I have read with much interest articles regarding standardizing work in machine shops, but very little about the drawings worked to. I have seen drawings in different shops, marked in such different ways as:

$$(a)\quad 2\tfrac{1}{4}\ {}^{-\,0.001}_{+\,0.001}$$

$$(b)\quad 2.249 \text{ to } 2.251$$

$$(c)\quad 2.25\ {}^{-\,0.001}_{+\,0.001}$$

All these dimensions appeared on the same drawing. To many of us they seem plain, but to others confusing.

Why not adopt a rule, or standard, and mark all drawings like (*b*), giving the maximum and minimum in each measurement? This would avoid the confusion sure to arise when fractions and decimals are mixed.

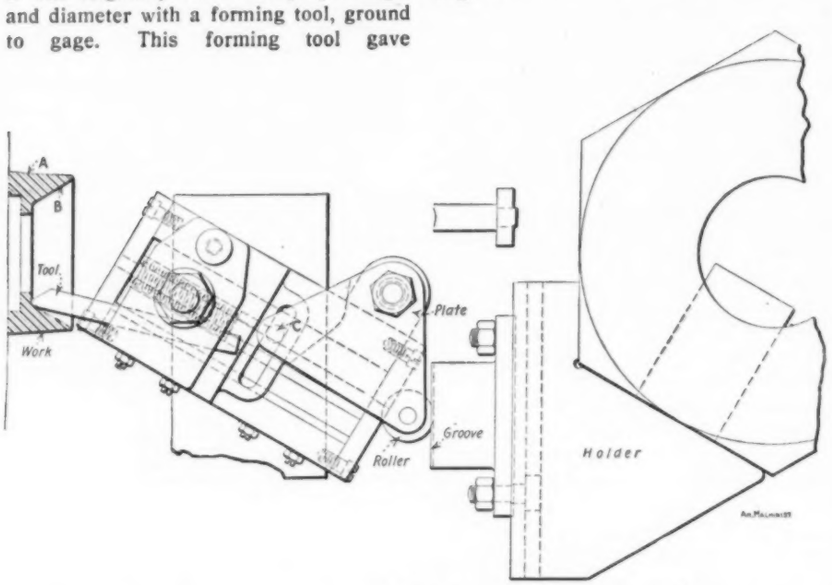
EDWARD T. CAUSER.

Sharon, Penn.

Fixture for Boring Commutator Rings on a Gisholt Lathe

In one of the largest electrical concerns in Germany the drop-forged commutator rings for small motors are bored

on a Gisholt turret lathe. When boring these rings, which are illustrated in section at *A*, the beveled surface marked *B* was originally cut to the proper angle and diameter with a forming tool, ground to gage. This forming tool gave trouble, as the cutting edge gave out frequently.



FIXTURE FOR BORING COMMUTATOR RINGS ON A GISHOLT TURRET LATHE

A very slow spindle speed was necessary, on account of chattering and poor finish. Because of the great number of these pieces used, it was necessary to design a fixture which would do better, quicker and more accurate work. This was accomplished by means of the fixture shown.

To bore a bevel gear of 30 deg. with an ordinary lathe tool fixed to the turret, it was necessary to derive a straight-line motion at that angle. This was accomplished by the movement of the turret head and holder, which movement was transmitted to the pin *C* by means of a roller and plate, and in turn, by the aid of the dovetailed slide shown, to the tool. After reaching the depth needed, the tool returns automatically, by the force of the internal spring shown, when released by the return motion of the turret.

The head and base are both graduated to degrees and halves, to adjust to any desired length. This fixture doubled the output, with the desired accuracy and finish. It may, of course, be used on other jobs of a similar nature.

RUDOLPH VON HUHN.

Schenectady, N. Y.

Multiple-Spindle Drilling

In the Royal Typewriter Works, Hartford, Conn., a number of multiple-spindle drilling heads are used for drilling various parts. In all these heads right-hand drills only are used, which is a custom by no means common in many shops where such heads are employed. One of these heads, in use on a Henry & Wright drilling machine, is shown in Fig. 1.

The general practice followed in their construction is shown in Fig. 2. The parts marked *A* are made of bronze. Those marked *B* are hardened steel and those marked *C* are the spiral spur gears, made of soft tool steel. The end *D* of the taper shank is hardened. The outer drill is driven from the center gear by the idler *E*.

New York, N. Y. E. A. DIXIE.

Tap Drill Sizes

In Vol. 36, page 533, is an article giving the following rule to find the practical size for U. S. standard tap drills: Outside diameter less ¾ the double depth of the thread. This rule gives a good size, but it seems to me is too complicated to become popular with the average tap operator.

A few years ago, I advocated a rule which gives almost exactly the same size and has the advantage of having the result almost stamped on each U. S. standard tap, as follows:

Outside diameter less pitch. On a 1-in. tap is stamped 1 in. — 8; the size of tap drill is 1 in. — ⅛ in. = ⅞ in.; on a ⅜-in. tap, ⅜ in. — 16; the size is ⅜ in. — 1/16 in. = 5/16 inch.

Where the result is not a drill size, the nearest size is chosen.

High Bridge, N. J. J. SCHURING.

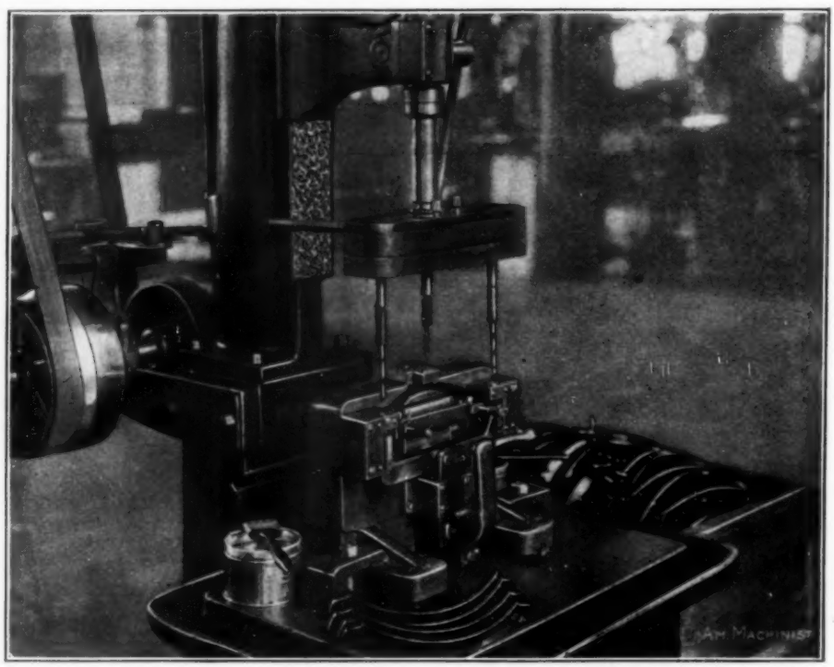


FIG. 1. MULTIPLE DRILLING HEAD IN THE MACHINE

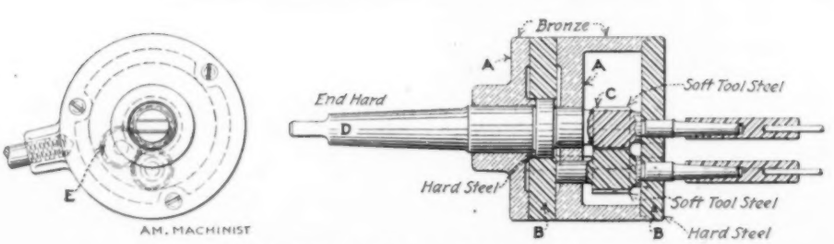
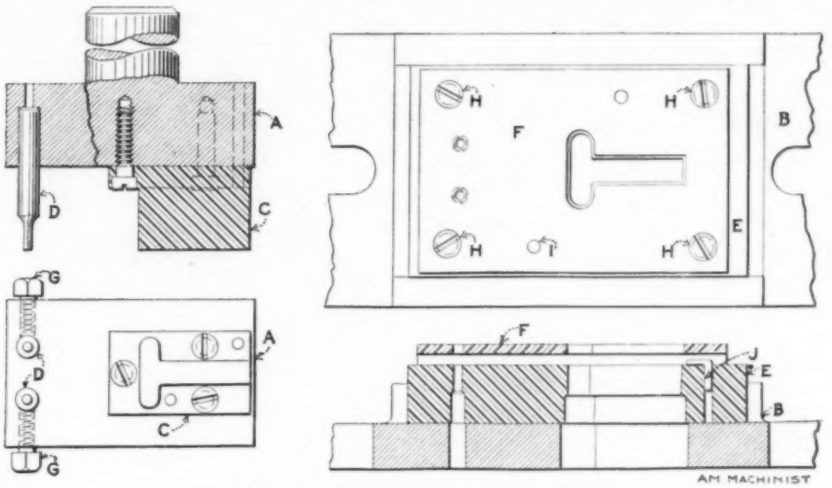


FIG. 2. DETAILS OF THE DRILLING HEAD

Planning Die Work

A method used in the planning and designing of dies for sheet-metal working is illustrated in the line engraving. This method has proved very successful and satisfactory, and it leaves the die maker free from all responsibility other than the efficient operation of the dies.



DIE DESIGN FOR SHEET-METAL MAKING

As will be seen the designs are made so as to be clear and easily followed. A total absence of figures on the die design is best, because as the drawings are made full size the die maker is not hindered by a mass of figures, and he can by simply consulting the table, easily secure the necessary castings and rough stock in short order, while the full-size drawings will help him to machine the various parts quickly and accurately.

In practice a drawing of the part to be punched is also furnished with all dimensions and limits of tolerance clearly shown.

Although the die illustrated is an extremely simple one, it serves to show how work of this kind may be expedited through the shop.

Many well equipped shops are unable to bid successfully for die work and stampings because of the great cost of getting such work planned and started. Very often this cost is as great, or greater, than that of the actual labor involved in making the tools. The method shown here will obviate this to a great extent.

J. V. WOODWORTH.

A Device for Gaging a Chuck Cap and Spindle Nose

Having a great many pieces like Figs. 1 and 2 to make, which must fit together perfectly at *A* and *B*, to be interchangeable, I cast about for a measuring instrument that would accurately measure the diameter of the taper *B* in relation to the face *A*. This I could not find. I therefore made a sketch of a measuring instrument and did not like it. After improving it, however, I produced a very good tool for measuring work of this kind, and while in its present stage it is not a universal tool, yet I think it can be adapted to a great many uses.

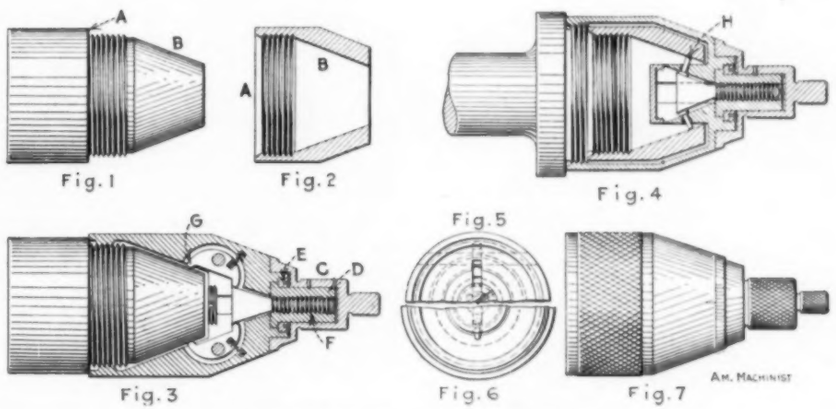
I give here, in Figs. 3 and 4, respectively, sectional views, showing the method of measuring the outside and the inside. It will be seen from Fig. 3 that I use the thread of the piece, in Fig. 1, to bring the measuring tool up to the face *A*, then operate the dial *C*, which is a tight fit on the nut *D*, and cannot move endwise because of the nut *E*, this nut being adjusted so that the nut *D* will turn freely. The nut and dial when turned cause the screw *F* to travel endwise, and this brings the measuring points *G* in contact with the work to be measured.

The piece in Fig. 2 is ground. The fixture for holding it while grinding also makes a holder for measuring, as in Fig. 4. The operations for measuring are the same as described, the measuring points *W* being different, and these have to be returned to a small enough diameter to pass through the hole in the piece, Fig. 2, before the measuring tool can be removed.

An end view of a portion of Fig. 3, showing how the screw *F* is flattened and fitted into the same slot that the measuring points *G* work in, appears in Fig. 5. Fig. 6 shows the corresponding view for the piece in Fig. 4.

The external view, showing the arrangement of the graduations, appears in Fig. 7. It will be noticed that this external view is of Fig. 4, but Fig. 3 has the same general appearance except that it is somewhat longer in the body. Both these measuring tools, if made carefully and used properly, give good satisfaction. I made the screw $\frac{5}{8}$ in. in diameter 24 pitch. When figuring the angle to be measured, the graduations will be two or three times as far apart as the ordinary micrometer graduations. With this tool, after using it for an hour or two, anyone can measure within 0.0005 in.

Defiance, Ohio. S. THOMPSON.



GAGES FOR CHUCK CAP AND SPINDLE NOSE

Grinding Aluminum

Recently we had occasion to grind a lot of aluminum castings on an emery wheel, and encountered considerable difficulty as the aluminum stuck on the wheel. It was impossible to obtain a smooth and satisfactory job with the wheel in this condition. Continually cleaning off the wheel with an emery-wheel dresser consumed too much time. We then took paraffin wax and held it on the wheel to fill up the pores and proceeded with our grinding without any further trouble.

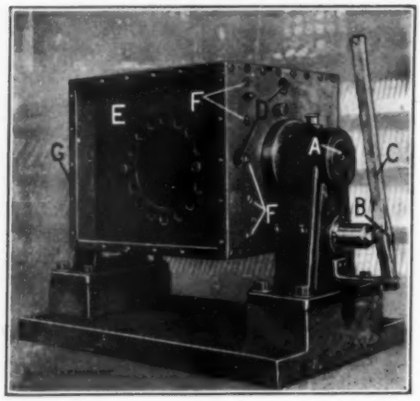
EDWARD J. RUTHMAN.

Cincinnati, Ohio.

Cylinder Drilling Jig

Some time ago I was asked to build a jig for drilling cylinders of a 9-15-hp. gas engine. The illustration shows such a jig. It is very heavy, as will be seen, but can be placed at a radial drill and need not be moved.

It is built to drill from four sides, swinging on the trunnions *A*, and having a locating pin *B*, which is operated by the lever *C*.



CYLINDER-DRILLING JIG

Tool-steel bushings, with $\frac{1}{16}$ taper to the inch, act as locating holes for the different positions. These are shown at *D*.

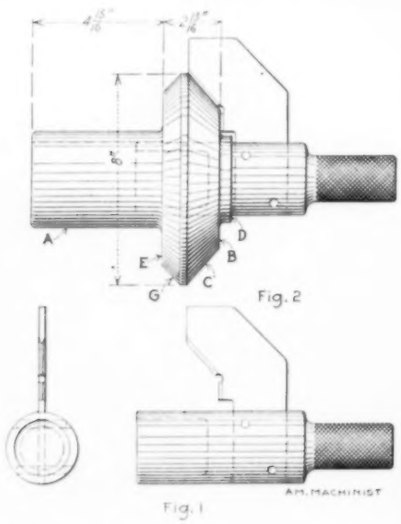
The plate E is easily removed by taking out the screws *F*. Another plate may then be placed at *G*, thus enabling you to drill a larger cylinder. The cylinder is easily located by pins, which are not shown, and a bar on the back with a large center.

ROBERT MUNCH.

Binghamton, N. Y.

Turning Bevel Gear Blanks

Before using the bevel gage shown in Fig. 1, we had a great deal of trouble turning the blanks of large bevel gears.



GAGE FOR TURNING BEVEL-GEAR BLANKS

As this gage is inexpensive to make, it is worth describing.

The hub *A*, Fig. 2, of the gear blank is chucked in a three-jaw chuck, then the blank is rough-bored, and rough-turned as far as the hub *A*. It is next finish-bored and reamed, after which the face *B* is finished and the bevel *C* finish-turned, using the gage as shown.

From the face *B* it is an easy matter to get faces *D*, *E* and *F* correct, and as the bevel *G* is not very important, a simple sheet-steel gage will do for it.

WILLIAM H. VOCKELL.

Oakley, Ohio.

Unusual Internal Grinding

A very clear idea of the method employed by a well known contract shop in getting out a rather unusual and fussy job of internal grinding is shown in Fig. 1.

The work consisted of a number of steel cylinders $11\frac{3}{4}$ in. in diameter by $5\frac{1}{16}$ in. thick with nine holes arranged in a circle around the central hole. These varied in size from 2.1778 to 2.3236 in. in diameter and were $4\frac{1}{16}$ in. deep, with a tolerance of $\pm$ 0.0002 in. on the diameters.

It was necessary that the nine holes bear an exact relation to the keyway in the center hole. In looking over the shop equipment, it was found that the largest internal grinder was too small for the work, so it was decided to make a fixture to fit an old Putnam lathe that had tumbler gears in the apron.

A bracket was made to fit the carriage in place of a cross-slide. On this was mounted a Brown & Sharpe internal grinding fixture and a drum long enough to allow the proper travel of the carriage. A 1½-hp. motor located on the floor back of the lathe and belted to the drum completed the grinding rig.

The reversing was done by taking off the old reverse lever and providing a new one with a pin that was connected with a reach-rod, provided with cushion springs and adjustable stop collars, to a forged bracket clamped in front of the headstock, as shown. The spring in front of the carriage held the gears in mesh and snapped the lever over at each reversal.

The location of the holes with relation to the keyways was accomplished by a very efficient indexing fixture, shown in section in Fig. 2.

Altogether it was a very satisfactory outfit and one of the most interesting things about it was the fact that it produced a better grade of work more rapidly than did a special grinder that was used upon a subsequent lot of parts.

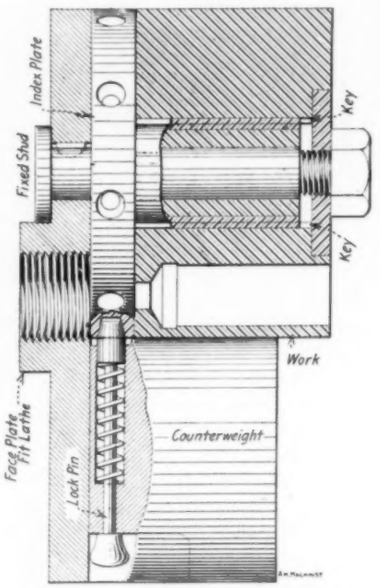


FIG. 2. THE WORKING FIXTURE

WINFIELD W. BLACKMAN.

Cambridge, Mass.

A deep black polish for iron or steel can be made by boiling one part of sulphur in ten parts of oil of turpentine. This mixture should be applied as lightly as possible and heated over a spirit lamp until the required polish develops.

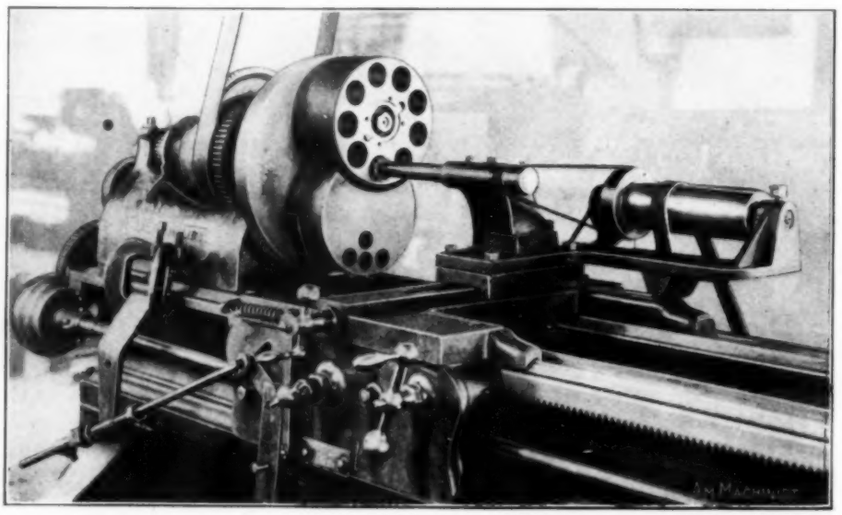


FIG. 1. LATHE FIXTURE FOR INTERNAL GRINDING

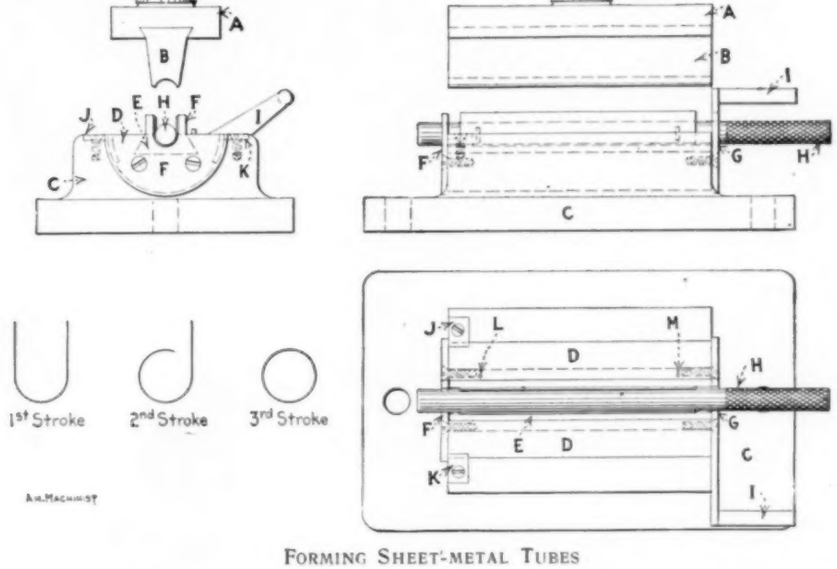
Discussion of Previous Question

Referring to letters and articles previously published

Forming Sheet Metal Tubes

Descriptions of tube-forming dies that would form a tube complete in one stroke of the punch have appeared in the AMERICAN MACHINIST from time to time.

These descriptions lead me to conclude that the dies would be of little value, when the edges of the stock are to overlap at the seam. The line engraving



FORMING SHEET-METAL TUBES

shows a tube-forming die which, though necessitating three strokes of the press ram to complete a tube, is much more rapid in operation than might at first be imagined as the three strokes are continuous, and the press runs about 130 r.p.m.

Referring to the drawing, *A* is the punch holder made of machinery steel. The punch *B* is tool steel left soft. The body of the die *C* is cast iron, machined on the bottom and top, and the radius is bored or planed for the tilting piece *D*, also a casting.

The die proper *E* is made of tool steel and dovetailed in *D* as shown by the dotted lines. The plates *F* and *G* act as guides for the mandrel *H* and also as a stripper. These plates extend slightly over the edge of *D* and keep it from moving endwise. The plate *G* is extended to receive the handle *I*. The pieces *J* and *K* are stops set into the die block.

The illustration shows a tube in place after the first stroke of the punch. The die is operated as follows: The handle *I* being in the position shown, the stock is placed against the gage pins *L* and *M*. The clutch is engaged, and as soon as the punch clears the work on the upstroke, the handle *I* is depressed as far as the stop *J* will permit. After the second stroke the handle is thrown in the opposite direction as far as the stop *K* will permit, the third stroke completing the work and making a nice tight joint.

It would, of course, greatly lengthen the life of the tool were the punch and die hardened, but as we have no way of finishing by grinding we leave them soft, therefore the punch requires redressing occasionally. We use drill rod for the mandrel, and when quite small in diameter enlarge one end by putting on a medium-size file handle.

A. J. BRICKNER.

Delphos, Ohio.

Length and Diameter of Spring

Answering P. Steiner's inquiry regarding the length and diameter of spring wound around a 1¼-in. arbor, to make 3½ turns before rewinding, it is my opinion that $\frac{1}{32}$ in. is rather thick to wind around such an arbor. I believe it advisable to make the spring thinner and increase the width to give sufficient strength.

A spring to give the best service should not be strained too near the elastic limit, as the spring will quickly lose its elasticity, take a permanent set and will be more likely to break. A spring should be so proportioned that each part will do its share of work. Great distortion at any point must be avoided.

Taking it for granted that Mr. Steiner must use the size of spring cited, I would suggest a length of at least 10 ft. This length will give any 20 convolutions around a 1¼-in. arbor when tightly wound, and an average coil diameter of 1⅞ in. The outside diameter of the tightly wound spring will be about 2½ in. The spring barrel should be about 3¼ in. inside diameter.

Assume that the outside diameter of the spring is 2½ in. when wound. It will swell in running down about 50 per cent. of the total thickness of the coil, which is $\frac{5}{8}$ in.; 50 per cent. of $\frac{5}{8}$ in. is $\frac{5}{16}$ in. But for a small margin we will say $\frac{3}{8}$ in. or a total increase in diameter of ¾ in., which will make the inside diameter of the spring barrel 3¼ in.

To prove this, we will say the spring has 16 convolutions when run down and an average coil diameter of 2¾ in. This diameter is derived from the fact that 16 thicknesses of $\frac{1}{32}$-in. material, equals ½ in., which would reduce the average diameter from 3¼ to 2¾ in. We will now see if 16 turns of this diameter will give a spring of 10-ft. length.

$$\frac{2.75 \times 3.1416 \times 16}{12} = 13.82 \text{ ft.}$$

From these figures it will be seen that 3¼ in. is a little larger than necessary; but it is better to have a margin of safety than to work too close. If, however, we must economize with space, the inside diameter may be made 3⅛ in., there must be, however, no projections to take up room, or imperfect coils.

M. B. STAUFFER.

Scottdale, Penn.

Making a Prime Number Wheel

On page 634 is a description of a method of cutting a prime number of teeth, in this case 109, in which the contributor, Ernest A. Howe, claims an error of only 0.002 in. in the thickness of teeth in the second gear cut. The manner in which this operation was accomplished is open to criticism.

In the first place he cut the gear half way around, setting his dividing head to

cut 108 teeth and then reset the dividing head to cut the remainder of the blank for 110 teeth. Now he cuts a 12-diametral pitch gear. Thus the pitch diameter = 9.08333 in. +, which, multiplied by 3.1416 = 28.53619 in., as the circumference of the pitch circle. This, divided by 2 = 14.268095 in. as half the circumference in which we cut 54 teeth. Then 14.26809 ÷ 54 = 0.26422 in. as the circular pitch for each tooth on half the circumference. On the other side we have 14.26809 ÷ 55 = 0.25942 in. as the circular pitch for the second half. Now, 3.1416 ÷ 12 diametral pitch = 0.2618 as correct circular pitch.

So on the 54-tooth side we have a + circular pitch of 0.26422 in. — 0.2618 in. = 0.00242 in., and on the 55-tooth side we have a — circular pitch of 0.2618 in. — 0.25942 = 0.0024 in. Thus the difference between the greatest and smallest circular pitches = 0.00482 in., or almost 0.005 inch.

As we have calculated the error per tooth on each side, let us see what the accumulated error would be. Multiplying 0.0024 in. by 54, which is the number of teeth, = 0.1296 in. +, or over ⅛ in. error +, and 0.0024 × 55, the number of teeth, = 0.132 in., or over ⅛ in. error —. From this it will be seen that the accumulated error has changed the positions of the teeth and spaces to such an extent that they are out on the circular pitch more than ⅛ in. from their true positions.

My advice to those engaged in gear cutting is to use one of the regular methods known to the trade for cutting prime numbers of teeth.

EDWARD J. RANTSCH.

Brooklyn, N. Y.

Soliciting Catalogs

The editorial comment, appearing on page 725, upon the abuse of the catalog privilege is very pleasing to me. The proper course in this respect, it would seem, is one of common honesty.

Some years ago I addressed the E. W. Bliss Co., of Brooklyn, N. Y., stating that I was not in the market for a machine nor did I have any expectation of inducing the firm employing me to buy a press, but that I was in a position where it was incumbent upon me to know all I could about presses and press development, and felt that their catalog would be a great help, and would be very grateful if they wished, under the circumstances, to send me one.

I received a courteous reply thanking me for the compliment paid them in asking their aid and saying that the catalog and other literature which might prove valuable had been forwarded. On examination the catalog was found to be a well-made book of considerable value, and the sum of 27c. in postage, alone, had been expended to place it in my hands.

At another time, when turret lathes were the subject of study, the Jones & Lamson Co. was approached with a full statement of the facts and responded promptly with a gift of their valuable book on their machine.

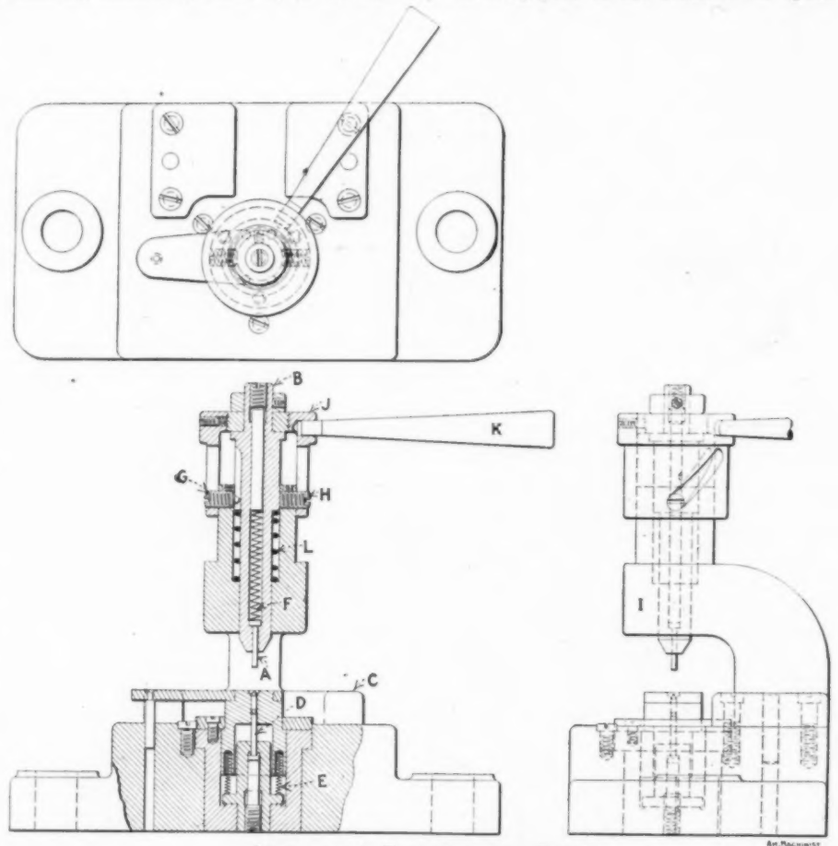
Noting my success in this matter an enterprising young man in the same factory sent several letters to leading firms merely asking for catalogs. The result was surprising. He received letters and telegrams saying that the representatives of the various firms would call, and it kept him busy for a short time sidetracking the visits of these gentlemen, while one of them actually got there and subjected him to no little embarrassment in explaining that he wanted merely a book, not a machine.

HERBERT V. PURMAN.

Rochester, N. Y.

Assembling Type Bars and Pivots

Having noticed a discussion in a previous issue, in regard to the efficiency of the punch press for assembling typewriter bars and pivots, I wish to show an assembling fixture, operated by hand, which does the work with one stroke, whereas the punch press with the magazine attachment, requires two.



ASSEMBLING TYPEBARS AND PIVOTS

The assembling of the pivot into the type bar is an operation which cannot be given too much forethought, as it affects the alignment of the finished typewriter.

The most important point about a fixture of this kind, whether it be operated by hand or foot power, is the location of the type bar while the pivot is being pressed into it. As type bars are usually blanked or swaged, the method of locating in a form or nest will not give satisfactory results.

In the hand fixture shown, the type bar is placed on the shelf and the pin *A* enters the hole, thus locating the bar. Further movement causes the ram *B* to descend until it rests on the work, when the base *C* sinks with the bar, which allows the pivot (which is loaded) to enter the hole. The pivot is supported by the pin *D*. The coil springs *E* return the base to its former position and the coil spring *F* causes the locating pin to return.

The ram *B* is kept from turning by the pilot of the screw *G*, which, with the screw *H*, is fastened in the cast-iron arm *I*. These screws are used as a guide in the cam slots, which are cut in the sleeve *J*, so that a twisting motion of the lever *K* will cause the ram to descend, after which it is returned by the spring *L*.

Driving pins in the holes is an operation which, in different forms, is common in all branches of manufacture, and when the work is to be done in quantities, the method of locating from the hole with a disappearing pilot will be found invaluable.

New York, N. Y. NEVIN BACON.

Wisconsin's Orders on Safety

The State Industrial Commission put into effect on June 14 general orders on safety covering points common to all industries, and special points applying to woodworking and the operation of elevators.

The Wisconsin laws of 1911 dealing with safeguarding against industrial accidents provided for the establishment of an industrial commission to fix standards of safety and to formulate rules and regulations relative to the enforcement of such standards.

In carrying out this work a committee on safety and sanitation was appointed to draft a set of rules. Edward J. Kearney, of the Kearney & Trecker Co., Milwaukee, Wis., was the chairman. A report has been rendered embodying a number of orders which went into effect on June 14. So far as we know, this is the first attempt to formulate a set of rules and outline what must be done to safeguard industrial operations, under legislative authority.

The commission sets up three standards which the orders are intended to put into effect. These are:

No safeguard required which cannot be proved practical.

No safeguard required which the commission cannot show how to install.

Home-made safeguards which, as far as possible, can be constructed and installed cheaply in the shop.

The following are the general orders, and those that apply specifically to woodworking machines and freight elevators.

Points of Safety Common to All Industries

Order 1. Belts, Guards. All belts, ropes or chains driving machinery or shafting, and all secondary belts, ropes or chains; in short, all belts, ropes or chains exposed to contact, except belts which are so small or those which move so slowly that there is no possibility of danger, must be guarded.

In all cases, the point where the belt, rope or chain runs onto the pulley, sheave or sprocket, must be guarded.

All horizontal belts, ropes or chains driving machinery or shafting 7 ft. or less from the floor, where exposed to contact, must be guarded.

Note (a): The terms "belts" and "secondary belts" mean belts which transmit power, and do not apply to sanding or polishing belts, or belts used for abrasive purposes; such belts must be guarded where possible.

Note (b): In guarding overhead belts or rope drives, unless so guarded that persons cannot pass under them, the width of the guard should not be less than the width of the belt or rope drive and the length should not be less than the distance between the outer faces of the two pulleys. It should cover the outer faces of the two pulleys or sheaves and extend upward to such a point, and be attached in such a way that in case the belt breaks it will withstand the whipping force of the belt.

Note (c): In rooms, or parts of rooms, used exclusively for transmission machinery, such as the ground floor of sawmills and the basements of paper mills or flour mills, it has been found practical to define certain passageways for the use of oilers and millwrights and to guard the pulleys, belt and shafts along these passageways.

Order 2. Pulleys, Guards. All pulleys over 18 in. in diameter, which are exposed to contact, must be guarded.

Order 3. Loose Pulleys. All machines not individually motor driven must be equipped with a loose pulley or clutch or some other adequate means of stopping the machine quickly.

Order 4. Belt Shifters. All loose pulleys must be furnished with a permanent belt shifter, so located as to be within easy reach of the operator. The belt shifter must be so constructed as to make it impossible for the belt to creep from the loose pulley back on the tight pulley.

All belt shifters must be equipped with a lock or some other efficient device which will prevent the shifter from being accidentally shifted.

Order 5. Pulleys Near Shaft Hanger. Pulleys must be so placed as to allow the width of the belt between two pulleys, or between the pulley and the shaft hanger, or a hook must be provided, or a guard placed adjacent to the pulley to prevent the belt from leaving the pulley.

Order 6. Clutches. All clutches must be guarded.

Note: Practically all clutches have protruding parts or screws which make them as dangerous as setscrews on shafts.

Order 7. Swinging Doors, Windows. All swinging doors in stairways and all doors swinging both ways in general passageways must be equipped with windows. One window must be provided for each section of double swinging doors. Both sides of the doors must be provided with adequate light, either natural or artificial, during the hours of active operations in the department in which said swinging doors are located. The windows must be kept free from dirt or other obstruction to the vision.

Note: In order to accommodate boys or girls, the bottom of the windows should not be more than 48 in. from the floor. The size of window which is recommended should not be less than 8x24 in. Guards should be placed over the window to protect the glass from being broken by protruding parts on trucks, etc.

Order 8. Emery Wheels, Hoods and Guards. Emery wheels used for grinding purposes must be equipped with a hood connected with an exhaust fan or water system. A guard must be provided, as a part of the hood construction or in addition to the hood, which shall be strong enough to withstand the shock of a bursting wheel. This guard must be adjusted close to the wheel and extend over the top of the wheel to a point 30 deg. beyond a vertical line drawn through the center of the wheel. The exhaust or water system is not required on emery wheels which are in general use by all employees in common, to touch up tools or castings, or emery wheels used for sharpening saws.

Order 9. Flywheels. All sections of flywheels with spokes, which are 6 ft. or less from the floor and which are exposed to contact, must be guarded. Flywheels which run in pits must be provided with toe boards around the pit.

Exception: Where an engine is isolated in a room used exclusively as an engine-room, the flywheel of such engine may be guarded with a railing. This railing must be not less than 30 in. in height, and must be constructed with two rails, the bottom rail of which must be not less than 18 in. from the floor.

Order 10. Friction Drives. The contact faces of all friction drives, when exposed to contact, must be inclosed.

All arm or spoke friction drives and all web friction drives with holes in the web, when such friction drives are over 18 in. in diameter, and exposed to contact, must be entirely inclosed. All friction drives with projecting bolts where exposed to contact, must be guarded.

Order 11. Gears. All gears, where exposed to contact, must be entirely inclosed or equipped with a flange guard, which must inclose the teeth of the gears. All arm or spoke gears and all web gears with holes in the web, which are over 18 in. in diameter, where exposed to contact, must be entirely inclosed.

Order 12. Keys and Keyseats. All projecting keys in shafting, where exposed to contact, must be cut off or guarded, and all keyseats in ends of shafts, where exposed to contact, must be filled or guarded.

Exception: Keyseats on machines where it is impossible to guard or fill the keyseats without interfering with the operation of the machine, and where such keyseats are in shafts which are so small or run so slowly that there is no danger.

Order 13. Ladder With Steel Points. All portable ladders must be equipped

with steel points or steel feet on the bottom, or other effective means of preventing slipping.

Note: Where steel points or steel feet are used they should be kept sharp, especially when used on concrete floors.

Order 14. Passageways, Keep Clear. All passageways and gangways must be kept smooth and in good repair and free from nails or obstruction over which persons may stumble and fall.

Order 15. Platforms With Stairways or Stationary Ladders. All permanent elevated platforms in frequent use must be equipped with a permanent stairway or stationary ladder. Ladders other than step ladders, used to gain access to elevated platforms not frequently used, must be provided with safety hooks at the top.

Order 16. Runways and Platforms, Rails and Toe Boards. All elevated walks, runways or platforms, except on loading or unloading side of platforms, must be provided with a guard rail. A toe board must be provided to prevent parts from falling off.

Order 17. Setscrews. All setscrews on moving parts, where exposed to contact, must be countersunk or protected by a solid collar, or a headless setscrew must be used. No part of the setscrews must project above the surface.

Order 18. Shafting. All transmission shafting in workrooms or in passageways leading to workrooms, and located less than 6½ ft. from the floor, where exposed to contact, must be guarded.

Order 19. Sprockets. All sprockets exposed to contact must be guarded.

Order 20. Stairways, Handrails. All stairways must be equipped with handrails, and the rails must be kept smooth and free from nails and splinters. Where the stairway is not built next to a wall or partition, rails must be provided for both sides.

Special Industries—Woodworking

Order 200. Jointers. All hand jointers must be equipped with safety cylinder heads and a guard must be placed over the knives to protect the hands of the operator.

Note: It has been found from experience that the safety cylinder head practically eliminates the possibility of serious injury to the hands. Many accidents have occurred on jointers with square knife heads which were equipped with guards over the knife head.

Order 201. Mats to Prevent Slipping. The floors where operators stand in operating dangerous machines used in manufacturing, such as wood shapers, jointers and circular saws, must be provided with rubber mats, gravel roofing paper or other effective means of preventing slipping.

Order 202. Band Saws. On all band saws the upper and lower wheels, and the saw must be guarded, except the part of the saw below the saw guide.

Note: The wheels of a band saw should be treated the same as flywheels and should be so guarded that a person will not be caught if he should stumble and fall against the wheels. It is necessary to guard the upper as well as the lower wheel because the operator is likely to get up on the machine to oil or adjust it while in motion, and there is always danger of his making a misstep and being caught.

Order 203. Circular Saws. All circular saws must be guarded and all such saws used for ripping, other than self-feed saws, must be equipped with a splitter. All other saws, where possible, must be equipped with a splitter.

Exception: On saws, while specific work is being done, where it is impossible to do the work when the saw is guarded.

Order 204. Machines With Knife Heads. All knife heads of wood shapers and similar heads of other machines, not automatically fed, must be guarded, or forms must be used in which the part operated on is securely fastened. All knife heads of woodworking machines, which are automatically fed, such as stickers, planers, etc., when exposed to contact, must be guarded.

Elevators

Order 400. Elevators, Catching Device. All elevators, except direct-lift, plunger elevators, must be equipped with an automatic device to catch the car in case it drops, and if the travel of the car of a power-driven elevator exceeds 15 ft., a speed governor must be provided. Safety devices must be tested for efficiency at least once each month. Cars which travel at a speed of 250 ft. or less per minute must have the governor set to operate when the speed of the car exceeds 50 per cent. of the regular speed. Cars which travel at a speed higher than 250 ft. per minute must have the governor set to operate when the speed of the car exceeds 30 per cent. of the regular speed.

On catching devices, to which speed governors are hereafter attached, the dogs or clamps of such catching devices must be attached to the under side of the car platform.

Every type of safety device for catching the car if it drops must be subjected to an actual drop test with the load equal to two-thirds of capacity, such test to be made under the direction of the industrial commission.

Every such safety device hereafter installed must conform to the standard types approved by such tests.

All power-driven elevators must be provided with automatic stops, which shall stop them at the lowest and at the highest landings independent of the operating cable or other device. All hand-power elevators must have such limit stops at the top.

Note (a): The speed governor is the only equipment which will operate the safety device when the car attains an excessive speed from broken machinery or other cause. Safety devices without speed governors operate only when the cable breaks.

Note (b): Purchasers of safety devices should make sure that the type of the device has been properly tested and approved by the industrial commission.

Order 401. Freight Elevators, Gates. All freight elevators must be equipped at each landing with self-closing gates not less than 5½ ft. in height, except at the top landing, where such gates must be not less than 3½ ft. in height. The bottom rail on all gates must be not more than 12 in. from the floor. The openings between the slats or bars on the gates must be not more than 3 in., except on the side of the operating cable, where the opening may be made sufficiently large to allow for the operation of the cable.

In case local conditions do not permit of a gate of 5½ ft. in height, a gate not less than 3½ ft. in height may be used, provided such gate is placed not less than 12 in. from the platform of the car, and provided that telltale chains, not less than 5 ft. long and not over 5 in. apart, are suspended from the edge of the platform in front of the opening. On the top landing the gate may be placed less than 12 in. from the platform of the car.

Gates on freight elevators, already installed, which are not less than 3½ ft. in height, and which are placed close to the car, will be permitted if the bottom rail of such gates is not more than 12 in. from the floor, and if telltale chains as above specified are provided.

Freight elevators already installed, if equipped with doors instead of gates, which doors are made of solid wood or metal, or of wire-glass, grill work or screen, will be permitted if such doors are equipped with self-closing locks which cannot be opened from the outside, except by means of a key, and provided such elevators are operated by an operator stationed on the car.

On hand-power elevators where it is necessary in order to operate the car, the gate may be made not less than 3½ ft. in height and placed not less than 2 in. from the car, provided telltale chains as specified above are attached to the car.

Gates swinging on vertical axes will not be permitted.

All gates or doors for entrances to freight elevators must be of sufficient strength to withstand a lateral pressure at the center of not less than 250 lb.

Order 405. Elevator Shafts, Projecting Floors, etc. All projections in elevator shafts such as floors, beams, sills and bolts, unless guarded against by the car inclosures, must be provided with smooth beveled guards, fitted directly under such projections so as to push any projecting part of the body back into the car instead of crushing it. This beveled guard

must be set at an angle of not less than 60 deg. with the floor level.

Order 406. Freight Elevators, Inclosure of Car. All freight elevator cars must be inclosed solidly on all sides except on entrance side, to a height of not less than 6 ft. On the side of the operating cable sufficient space should be allowed to operate the cable.

All freight elevator cars must be equipped with a covering over the top, either solid or made of wire screen not less than No. 10 wire, and with mesh not over 1 in. The part of such covering which faces the opening to the shaft, must be constructed with a section not less than 18 in. in width and extending the width of the opening to the shaft. Such section must be so attached with hinges to the screen that it will rise when it meets with an obstruction as the car descends.

Where there is more than one entrance to a freight elevator car, if such entrances are not on contiguous sides of the car, or if the floor levels at each landing are not the same, or if there are more entrances to the shaft on one side than on the other, such other entrances to the car farthest from the place where the operator stands must have a gate not less than 6 ft. in height, and reaching down flush with the floor.

Plain Radial Drilling Machine

The illustrations show the newly designed, plain, radial drilling machine of the Cincinnati-Bickford Tool Co., Cincinnati, Ohio.

It will be seen from Figs. 1 and 2, that in the design of this machine a stiffly proportioned construction is secured; all gearing is completely inclosed, and the operating handles are conveniently located.

The column has an inner trunk secured to the base and an outer sleeve which revolves thereon, and is clamped directly to its enlarged part so that the two parts of the column becomes practically a single member when the sleeve is tightened.

The trunk extends up to, and has a bearing at the top of the sleeve, is internally ribbed in its planes of greatest stress and is provided with both thrust and annular ball bearings to reduce to a minimum the force required to position the arm for drilling.

The arm is of pipe section to secure maximum strength. The elevating screw has a ball thrust and provision is made so that the screw can never be set in motion accidentally or continue in motion after the arm has reached its limit of movement. The arm lowers at double its elevating speed and is provided with limit screws to prevent undue sagging when the binder levers are unclamped.

The drive is furnished in four different ways; that is, it may be a cone drive, speed-box drive, variable-speed motor drive, or motor and speed-box drive. The cone gives 15 changes of speed, the extremes of which coincide with those obtained from the speed box, while the number secured from the variable-speed motor drive is practically unlimited.

The latter drives through a single pair of gears, while the constant-speed motor drive transmits power to the speed box through a set of three gears, the largest of which is provided with means for absorbing such slight shock as occurs at the moment of changing speeds.

The speed box is controlled by a single lever and gives with the back gears 24 changes of speed, which are obtainable

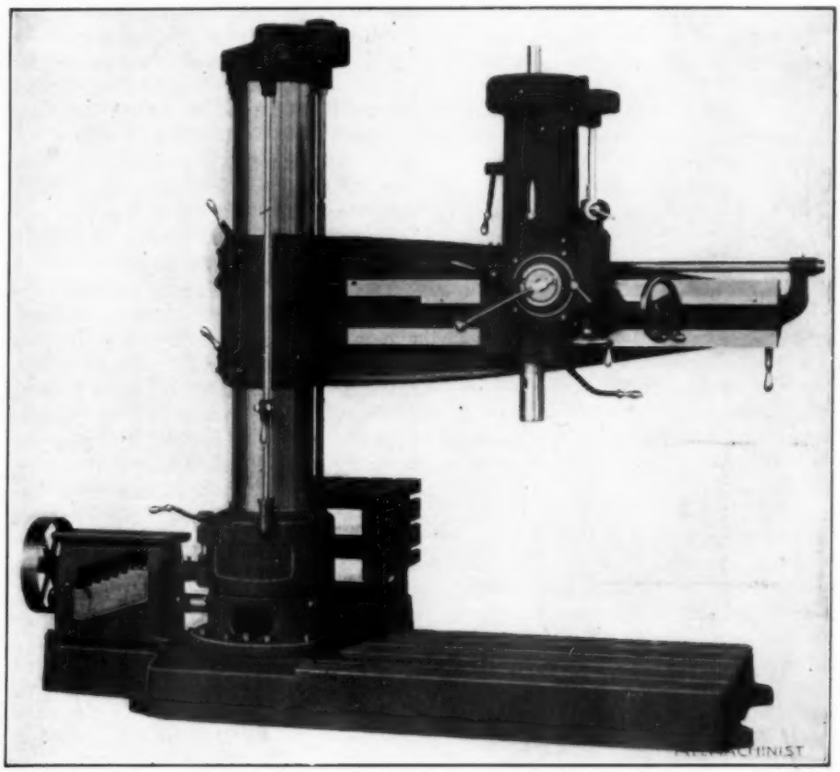


FIG. 1. CINCINNATI-BICKFORD PLAIN RADIAL DRILLING MACHINE

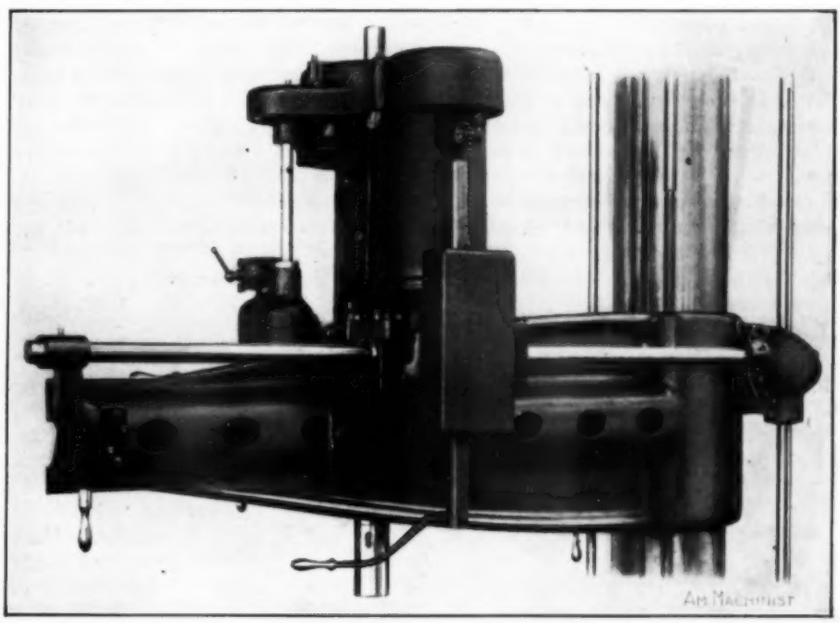


FIG. 2. REAR VIEW OF RADIAL DRILLING MACHINE ARM SHOWING METHOD OF INCLOSING GEARS AND CARRYING COUNTERWEIGHT

by hand or foot, as no locking device is required for the lever. The box is provided with a speed plate and tool tray, and permits setting the machine at right angles to the shafting by using a quarter-twist belt. The speeds are in geometrical progression and are efficiently arranged, the three sizes in which the machine is built, namely, 4, 5 and 6 ft., being speeded, respectively, to drive a ¾-in. drill at the rates of 68, 61 and 53 ft. per minute.

The range of spindle speeds for the three sizes of machines is as follows: 4-ft., 21 to 347 r.p.m.; 5-ft., 19 to 310 r.p.m.; 6-ft., 16 to 270 r.p.m. The bearings throughout the driving works are bushed with bronze.

The back gears, consisting of six gears and a clutch, are incorporated in the

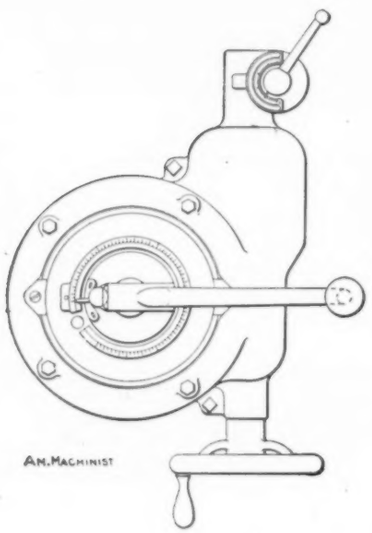


FIG. 3. DIAL DEPTH GAGE ON HEAD

head and furnish three changes of speed, each of which transmits approximately 2.7 times the pulling power of the next faster one. These gears engage instantly while running, and while fully protected by guards are readily accessible. They are all of steel and four of them, including the clutch, are hardened. The clutch is positive and operates with a sliding gear, the teeth of which are rounded to facilitate engagement.

The head is well balanced, as shown by Fig. 2; it is conveniently operated, supports the feed worm on either side and is of stiff design. The spindle sleeve, which has a long bearing in the head, exerts its pressure on the spindle through a ball-thrust bearing and is provided with a safety stop that trips the feed before the spindle has reached its limit of travel.

The automatic trip is incorporated in the design of the dial depth gage and quick-return mechanisms. The depth gage, as shown in Fig. 3, is in the form of a large graduated dial, which reads from zero in either inches or millimeters. It is always within full view and convenient reach of the operator. The mere setting of it, an operation instantly accomplished, automatically positions the dog to trip the feed at the desired point. The quick-return lever, which controls the vertical movement of the spindle, engages the feed the instant it is pulled and is provided with suitable means for increasing or diminishing the gripping power of its friction ring.

The feed mechanism advances the spindle at the five rates of 6, 9, 13, 18 and 24 thousandths, or 0.15, 0.23, 0.33, 0.46 and 0.61 millimeter per revolution, each rate being obtainable by setting the pointer to the desired position. The mechanism, which is entirely encased, contains a ball bearing to receive the thrust of the worm.

The tapping hood, which may be supplied, drives through friction clutches and enables the operator to start, stop and reverse the spindle without shock. Either a plain or universal table may be furnished. Where required a special base is supplied, and is equipped for maintaining a continuous flow of cutting fluid on the drill when drilling steel. The base is provided with a reservoir, chip strainer, pad for mounting the pump, and channels for the liquid. The pump is of the geared type.

A Parallel Opening Lap

BY R. A. CUSHING

The engraving shows a lap which may be of interest to readers of the AMERICAN MACHINIST.

The problem was to design a lap which would lap out a hole perfectly straight. The trouble with the old style lap, which is expanded at one end only, was a tendency to increase the diameter of the hole at the outer end, causing what is known as bell-mouthed ends. This lap wholly overcomes this difficulty and with ordinary care in handling will lap a hole perfectly straight and round. It is constructed in the following manner:

The spindle is turned and threaded, as shown, and made to fit at one end the machine in which it is to be used. It is then milled on a taper (four degrees in this case) so as to leave three keys or tongues extending to drive the lapping pads which fit between them.

There is one nut at each end, threaded to fit the spindle and knurled on the outside diameter. Both nuts are countersunk, to receive the pads, at an angle of 45 deg., and perfectly true with the thread.

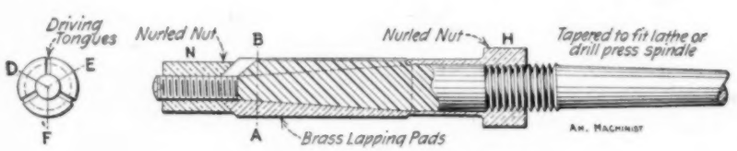
To make these, a brass bar of suitable length is taken, through which a hole is drilled, the diameter of which is equal to that of the small end of the spindle at the point where the lap is opened to its greatest diameter, *A B*, in the sketch. Then, having a straight hole for the distance that the lap projects onto the straight part of the spindle, when in its minimum diameter position, bore and ream a taper hole corresponding to the taper of the spindle.

The tube is then mounted on a suitable arbor and split in three places with a saw of such width that the three pads will fit snugly in place on the spindle, in the position shown. They are next clamped on the spindle and the ends turned to fit the nuts. The nuts are then placed in position and the outside diameter turned to the size lap required.

Several sizes of laps can be used on one size spindle. As fast as the lap wears it can be increased in size by backing off the nut *H* and following up with the nut *N*. The pads move out in a perfectly parallel line as they rest at their center, *DEF*, for the full length of the taper. Their diameter is kept a perfect circle as their ends fit into the bevel ends of the nuts.

Care must be taken that the pads rest at their centers and not at their inside corners, otherwise the lap will not open in parallel lines. As the lap is opened it will be noticed that the pads do not fully fill their pockets. This is not a detriment, in fact, it allows for the accumulation of oil and emery to good advantage.

This lap has an exceedingly long life and gives excellent results. The first cost is high compared to the old-style laps, but the total cost, when used continually is greatly reduced because the spindle can be used indefinitely, and the pads themselves, which are simply and cheaply made, are good for three or four days continual service.



A PARALLEL OPENING LAP

Chemically asbestos consists of silica, magnesia and lime or pyroxene. It was woven into cloth by the Greeks and was used for wrapping dead bodies when they were burned in the funeral pyre, that the ashes might be preserved.

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Of this issue, 21,500.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 165

American Machinist

Economic Significance of Fire Waste

"Money to burn." Such seems to be one American motto. To live up to it, we burned a million dollars' worth of property every day during January, February and March, of this year. Last year our fire bill was $250,000,000.

Who paid that bill? Who paid the million dollars a day between January 1 and April 1? Who pays for fire waste anyway?

There is an old saying, "A penny saved is a penny earned." Americans do not believe that maxim, when the penny is invested in something that will burn and protected by a fire-insurance policy. The attitude is: "Let it burn, the insurance company will pay."

But what with? Do the companies have an Aladdin's lamp that can be rubbed every time there is a fire? Do their funds come from some source other than the pockets of producers? Is this one place where the ultimate consumer goes "scot free?"

Everyone of us pays our part of the fire tax of this country. The tax is indirect. That is why we do not see it. Americans are said to love indirect taxes. Every fire that destroys property in our great country reduces the wealth of the nation. It destroys something that labor has produced, thereby impoverishing the nation just so much, and puts a fresh burden upon labor to replace that which is gone.

The economic significance of our fire waste is the reduction of the wealth of the nation by the stupendous amount of $250,000,000 annually.

If we were called upon to pay our part of this sum directly to some federal tax gatherer, the Boston Tea Party and Stamp Act agitation would be forever eclipsed. The French have a saying: "By indirect taxation one gets the most feathers for the least squabble." A quarter of a billion of our dollars go up in smoke each year with hardly a murmur, much less a squabble.

Europeans have a right to look upon us as children playing with fire, as willful incendiaries. It is surprising that they can understand us at all, for they are as alive to economic conditions, as we are ignorant of many such things. Were it not for our enormous wealth and tremendous resources, we could not stand this strain. But we are supposedly beginning to awaken to the need of conservation.

Here is a starting point for each one of us. Let us recognize that we are paying our part of this indirect fire tax. Every fire loss demands that we must perform a certain amount of additional labor to replace that which is gone. Have we not enough self interest to do our part in reducing this waste, in freeing ourselves from additional labor that should be unnecessary?

But the money waste that is indirectly taxed is only a part of the price we pay. Not only do we burn up property, but we destroy life. Paralleling the motto "Money to burn" is another, "Lives to burn."

Teaching Management Fundamentals in Technical Schools

It is evident that every young engineer should know something of the finance of manufacturing and of the fundamental principles which underlie successful modern industrial administration. Some of the technical schools for a number of years past have been giving their students instruction in such fundamentals as far as the limits of curriculum will allow. How much of this sort of work can, or should, be given in an engineering course does not yet appear, but without doubt all good technical schools will eventually include some instruction in this important subject in their work.

As far as engineering schools are concerned the amount must be limited for two reasons: The first is that the crowded conditions of the curriculum will not permit of much of this work without forcing out some other fundamentals. The other is that such schools of the higher grades are concerned with educating men to be engineers first and industrial managers incidentally.

There are, of course, lines of work where improvements in methods of management may be effected without a knowledge of any kind of engineering, but in a general way successful "efficiency engineering" or "scientific management" or whatever name we may choose to call this movement by, rests on a knowledge of the fundamentals of engineering.

Yet we read of elaborate attempts to install, in technical schools, courses in scientific management embracing instruction not only in the fundamentals of this work but going into minute detail, and involving a great amount of work on the part of the student. Of course, there are types of schools with certain local surroundings in which such work may be logically carried on, but the work of these schools should not be confused with that of the engineering college.

The curriculum of the good engineering college is the result of the law of the survival of the fittest and there is little place in it except for clear-cut fundamentals. The fundamental principles of so called "scientific management" are not numerous and are easily absorbed. Teachers in such colleges will do well not to become hysterical over every new phase of industrialism. It is easy to introduce new matter into the curriculum. It requires judgment to exclude instruction in the details of the particular movement which at the moment is agitating the practical field.

The Co-operative School

The question has frequently been asked, "What type of industrial school will best meet American needs?"

On page 985 Charles H. Winslow, expert on industrial education, with the U. S. Bureau of Labor, answers this query in a discussion of coöperative schools. We quote:

In the last analysis industrial education will be measured by intensely practical men of the industrial world, on the basis of skill and intelligence as developed by these undertakings to fit the youth of the country for wage-earning occupations. In order to meet this test successfully, apprentices must be trained under real conditions of productive industry, thereby making the coöperative school plan a necessary feature of our school system.

This definite statement is then amplified thus:

The public schools should teach the theory of the trade, while the actual practice and processes should be taught in the shop. By this method the boy, the employer and the community are benefited. The obligation to provide industrial education of a theoretical nature, therefore, should rest entirely with the public schools.

With all of these statements we heartily agree. Today's answer to our opening question is, "The coöperative school."

New Publications

CARE OF BELTS. By C. J. Morrison. Published by Suffern & Co., 149 Broadway, New York. 16 pages, 6x9 in. Price, 50c.

This is a concisely written and fully illustrated pamphlet on a subject which has received all too little attention in the average shop. It shows the equipment necessary to care for and repair belts; shows how the belt-repair bench, belt clamp and belt stretchers are made and gives many practical suggestions which will help to reduce belt cost in any shop.

It takes up the question of belt dressing, the splicing and lacing of belts; illustrates the use of takeup pieces, shows how belts should be laced and gives a suggestion for a belt-record card by which anyone can see exactly what is accomplished by systematic care of belting. Although a small pamphlet, it is about the only thing in print on this important subject and is thoroughly practical in every way.

THE INVENTOR'S OUTLOOK. May, 1912. Vol. 1, No. 1. 9x12-in. pages. Published by the Inventor's Outlook Co., Washington, D. C. Subscription price, U. S., $1 per year.

This first number carries 14 reading pages, devoted to matter interesting to inventors. From the editorial announcements, the journal is to deal impartially with the common needs of inventors; will struggle to improve their conditions, to defend them against injustice and provide a free forum for the discussion of the great problems which confront them.

It is expected that notable persons will be contributors, and as a beginning, we find an article written by Prof. Steinmetz, on "The Inventor's Side," and an interview with Thomas A. Edison, in regard to the patent system. In connection with a plea for new office buildings, two interesting illustrations are shown, one, the ruins of the post and patent offices burned in 1836, and the other, the ruins of the patent office burned in 1877.

There probably is a field for an inventor's journal, although former publications of this nature have not had a happy career. We trust the course of this latest comer will be marked by constructive action, and are pleased to find nothing in this first issue that indicates the contrary.

WORKS MANAGEMENT. By William Deane Ennis. 194, 6x9-in. pages, illustrated. McGraw-Hill Book Co., New York. Price, $2.

To what extent the principles of Works Management will form part of the curriculum of technical schools will take some time to decide; but this book is only one of many indications that educators are giving the matter serious consideration. It is written with the view of being available as a textbook though it contains much that may interest practitioners.

The book consists of ten chapters as follows: Chapter 1, entitled Management Units, contains a discussion of the units in which costs are reckoned in various industries; Chapter 2, Cost Elements and Classifications, discusses the elements of costs and classifications of accounts; Chapter 3, entitled Statistical Records, deals with necessary and unnecessary statistical records and some graphical methods of recording costs and other data; Chapter 4, entitled Labor, is a discussion of labor costs and the various methods of rewarding labor, with a discussion of their several merits and disadvantages; Chapter 5, while labeled Material, is really an exposition of purchasing and storeroom problems and a better name for it would be "Purchasing and Stores"; Chapters 6 and 7 treat of Burden and Depreciation respectively; Chapter 8, entitled Industrial Organization, is a discussion of the various forms of industrial ownership and organization, including labor organizations and labor difficulties; Chapter 9 contains a very brief discussion of the Principles of Accounting; Chapter 10 called Plant; The Physical Basis of the Industry, treats of plant location, construction and grouping of buildings, and of plant valuation.

There is also an appendix containing graded exercises which will be found useful for classroom work by teachers who may wish to use the book as a text.

The book contains much good material which will interest both teachers and practitioners who wish particularly to obtain a good general view of this field of work. The arrangement of the book, however, is poor. Such matters as burden, costs, purchasing, stores, etc., grow out of and follow naturally after a discussion of organization and do not precede it as in the above arrangement of topics. The treatment of many of the topics is too brief even for a textbook which may, of course, be supplemented by lectures, while in other places extreme detail is indulged in at the expense of more important matter. The book will, nevertheless, well repay reading and is a valuable addition to the literature of the subject.

The author's statement that "Increase of profit through better management costs no man anything and benefits every man in some measure" and that "to increase the labor-hour production is the highest human good" will scarcely be accepted by thoughtful men. Increased production of profit may or may not benefit the worker, depending on many factors. In fact, far from being an assured fact, we have many instances where the opposite result has occurred. Increased production results in increased benefits to the actual producer only when fair and equitable *distribution* of profits is assured, and at present that is far from being a universal accomplishment.

Personal

J. D. Cox, president of the Cleveland Twist Drill Co., Cleveland, Ohio, sailed, on June 11, for a European trip.

Charles A. Moore, president of Manning, Maxwell & Moore, has returned from Europe after an absence extending nearly two years.

E. R. Lyman, who was formerly manager of the Detroit plant of the U. S. Radiator Corporation, has been appointed assistant manager of the Dexter Folder Co., Pearl River, N. Y.

J. Paul Clayton, until recently assistant in mechanical engineering at the Engineering Experiment Station of the University of Illinois, is now a member of the engineering force of the Union Gas & Electric Co., Cincinnati, Ohio.

Frank H. Jones, for the past 10 years general superintendent of the Warner Gear Co., Muncie, Ind., has resigned in order to become associated with the Muncie Gear Works, with whom he will act in the capacity of general superintendent and mechanical engineer.

J. Everett Knapp, for a long time identified as master mechanic and engineer with the Randall-Faichney Co., Boston, Mass., has discontinued his services with them. Mr. Knapp contemplates the incorporation of a company for the manufacture of a line of dental and surgical instruments.

Joseph V. Woodworth, consulting engineer at the New York office of the Taft-Peirce Manufacturing Co., Woonsocket, R. I., has resigned and accepted the position of consulting engineer and New York representative of the Boston Pressed Metal Co., Worcester, Mass., with offices in the Tribune Building, 154 Nassau St., New York City.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Rochester Table Type Boring Machine

The illustrations show a table type of horizontal boring machine built by the Rochester Boring Machine Co., Rochester, N. Y., embodying the concentrated features of their floor type machine. Although all the boring mechanism remains in the head, the design has been materially modified in many ways. Sliding gears provided with clutches have replaced the tumbler gears formerly used, and all gearing is now made larger and more substantial than before.

The use of sliding gears does away with the openings in the head and a rawhide wiper has been placed at the end of the bearing to keep chips out of the bar and its bearing. This allows the gearing to be run in oil, which is supplied by a special plunger pump driven from the bar itself. The handwheels are now clutched so that they may remain idle when not in use.

The drive can be either right angle or parallel by simply shifting the bonnet carrying the single-drive pulley, the clutch and the driving shaft, from the end of the bed to the back, both holes being bored when the machine is built.

Although the essential features of the driving mechanism remain the same as before, some of the details regarding the arrangement of the gearing have been changed in accordance with experience with earlier machines. The principle of the driving and feeding mechanism was clearly shown in Vol. 33, Part 1, page 1177.

The boring and milling feed is distributed by the handle *A;* the feed changes are controlled by *B*, and speed changes by *C;* while all feeds are reversed by *D*. The lever *E* controls the rapid traverse, *F* the feed back gear, *G* the speed back gear; *H* is the elevating handwheel. The hand feed is by the wheel *I;* the lever *J* controls all the power movements through a clutch. The lever *K* controls both the saddle and table according to its position, with a safety stop to prevent

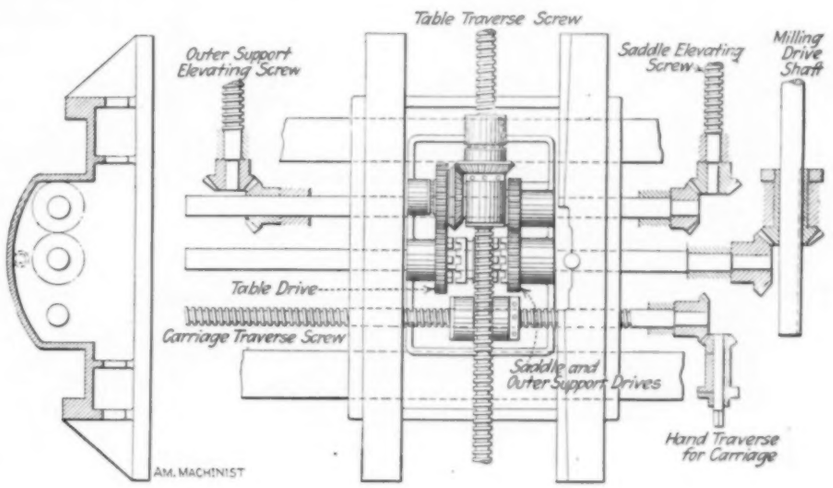


FIG. 2. DETAILS OF TABLE MECHANISM

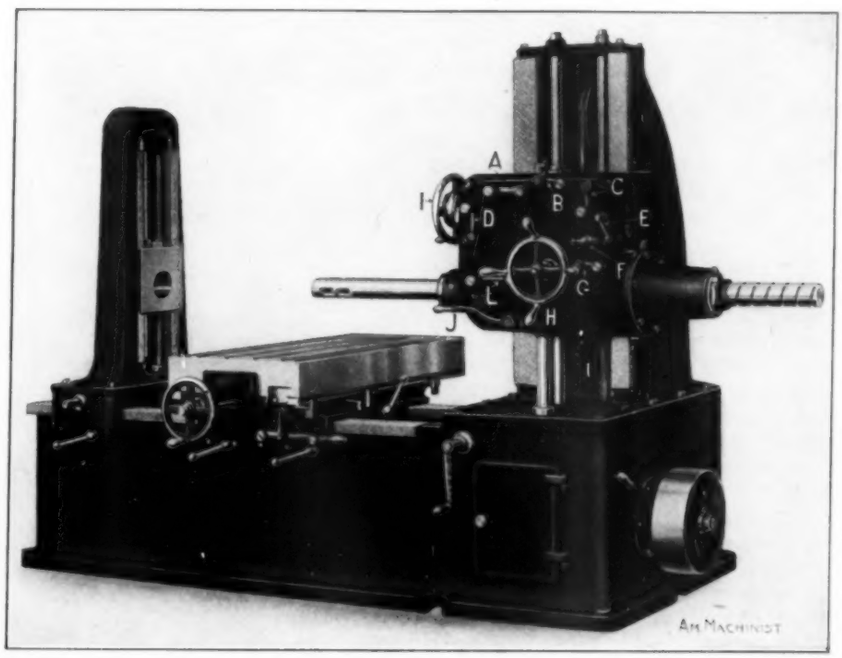


FIG. 1. TABLE TYPE ROCHESTER BORING MACHINE

throwing directly from one to the other. The lever *L* handles the high and low spindle speeds.

Sixteen boring and drilling feeds are provided and the same number of milling feeds can be had for the saddle and table. The operating levers concentrate control of all movements of spindle, saddle and table. Power rapid traverse is at constant speed and is independent of the feed. Automatic limit stops or

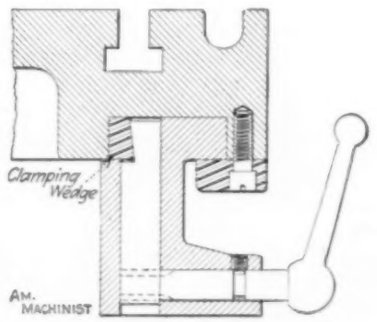


FIG. 3. LOCKING CLAMP FOR TABLE

"safeties" are provided for movements in all directions, in addition to adjustable knock-outs for the feed of the table.

It is impossible to engage two conflicting speeds or traverses at the same time; a single lever controls the reverse of all these and the speeds. The drive for the table and the outer support is through three shafts which run in oil in a pocket or reservoir formed in the bottom of the table, power being distributed from this central point in all directions.

Floating nuts are used on feed screws to avoid cramping and are made in two parts, adjustable in opposite directions, so as to take up wear and prevent lost motion. Some of the new details are shown in Figs. 2 and 3, their operation being so evident as not to require detailed description.

In addition to boring, drilling and milling, the machine is arranged for splining by using the power rapid traverse and driving the spindle in and out without its being rotated. To accomplish this, the spindle gear clutch is brought to a neutral position; the spindle driving gears are disengaged and a key is inserted in the milling clamp collar at the end of the saddle which engages one of the splineways in the spindle. The milling clamp collar is held from rotation by a friction band, tightened by a thumbscrew on the outside of the bonnet. The collar and spindle are thus secured against relative rotation, but the spindle is guided in its endwise motion by the key.

Spiral oil-groove cutting, which is in reality thread cutting, can also be obtained by using the power rapid traverse for the spindle and at the same time engaging any one of the spindle feeds, thereby rotating the spindle. By the combination of direct and back gears for the feeds and the 12 speed changes for the spindle, many different pitches of oil grooves or threads can be cut.

There is a convenient indicator provided on the front nose of the saddle, showing the exact center of the spindle, for the convenience of the operator in locating with the surface gage from the table when boring. These machines are built in two sizes, one with a 3- and the other a 3½-in. spindle.

Universal Cylinder Boring and Milling Machine

This universal cylinder-boring and milling machine is designed to simultaneously bore two twin-cylinder automobile-engine castings and mill the flanges on two more castings. By revolving the table the castings that have been milled are brought into position to be bored.

The machine consists of a substantial bed, supporting at one end a carriage with two boring heads, each carrying two spindles; at the other end is a crosshead, carrying a saddle with two milling spindles; near the middle of the head is a revolving table.

The revolving table is 54 in. square and is provided with a ball bearing, which, when raised into position by a handwheel, takes the weight of the table and allows it to be revolved easily. When the machine is in operation, the table rests on a scraped surface of large diameter. The table has four stop-pin holes and can be securely fastened after locating with the locking pin.

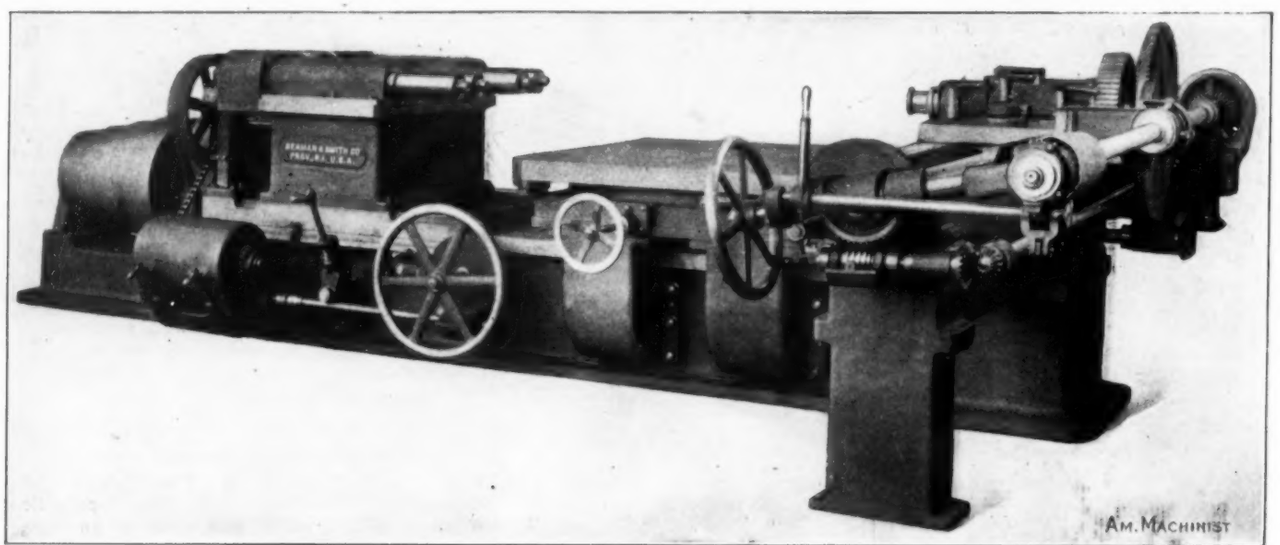
The carriage is 34 in. wide, 54 in. long and has a 30-in. movement on the bed. It has a quick power movement of 6 ft. per minute in either direction, independent of spindle drive.

The boring spindles are driven by a 6-in. belt on a four-section cone, from 17¼ to 24 in. in diameter. The milling spindles are driven by a 5-in. belt on a 3-section cone, from 11½ to 16 in. in diameter. The quick power movement for the milling carriage is driven by a 4-in. belt on a 10-in. pulley.

The least and greatest distance from the center of the table to the face of the boring heads is 27 in. and 57 in., respectively. From the center of the spindles to the top of the table the distance is 9⅝ in. From the center of the table to the end of the milling spindles, the least and greatest distance is 28¾ in. and 31¾ in., respectively. From the center of the spindles to the top of the table is 9¾ inches.

The milling saddle is 20 in. wide, 41 in. long and has a movement of 52½ in. on the cross head; it also has a quick power movement from 6 to 11¾ ft. per minute in either direction. The carriage has geared feeds at the rate of 4, 8, 16 and 32 revolutions of the spindle to 1 in. travel of the carriage. Feeds for the milling head are from 1 in. to 4¼ in. per minute at any spindle speed. The boring and milling spindles are of crucible steel running in hard bronze boxes. Means are provided to compensate for wear in the bearings and the speeds of the boring and milling spindles are 22½, 28, 35, 44 and 7½, 10 and 14 r.p.m., respectively.

The countershaft for boring spindles has a tight and loose pulley, 16 in. in diameter for an 8-in. belt, to run 265 r.p.m. The countershaft for the milling spindles has a tight and loose pulley, 14 in. in diameter for a 4-in. belt, to run 215 r.p.m.; also two loose pulleys 14 in. in diameter for a 4-in. belt to drive quick power movement. The weight is approximately 28,000 lb. The machine is a recent product of the Beaman & Smith Co., Providence, R. I.



UNIVERSAL CYLINDER-BORING AND MILLING MACHINE

Pulley Covering

The American No-slip Cement Co., Boston, Mass., has recently perfected a pulley cement covering which it is marketing under the trade name of "Palium."

It is easily applied with a brush, dries quickly, and produces a firm, dry, permanent covering calculated to reduce belt slippage.

In a series of tests conducted at the Massachusetts Institute of Technology to determine the relative efficiency in power transmission of cast-iron pulleys before and after treatment with "Palium," in regard to slip and coefficient of friction, the following results were established: 55 per cent. decrease in slip in favor of pulleys covered with "Palium," the belt tension varying from 60 to 80 lb. per inch of width; a decrease in the coefficient of friction from 0.189 to 0.169 on "Palium."

Press Safeguard

In Vol. 35, page 1045, there was shown a press safeguard made by the H. & A. Lock Co., of Brooklyn, N. Y., which has since been improved.

The original guard was operated by the foot treadle alone, as shown in Fig. 1, it being so timed as to rise previous to the tripping of the press.

The improvement, as shown in Fig. 2, consists of an additional set of levers, so that the guard is operated at each revolution of the crank, regardless of whether the treadle is pressed or not. Any accident to the treadle or clutch will not prevent the raising of the guard.

In Fig. 1 the guard is shown lying flat on a level with the top of the die, and

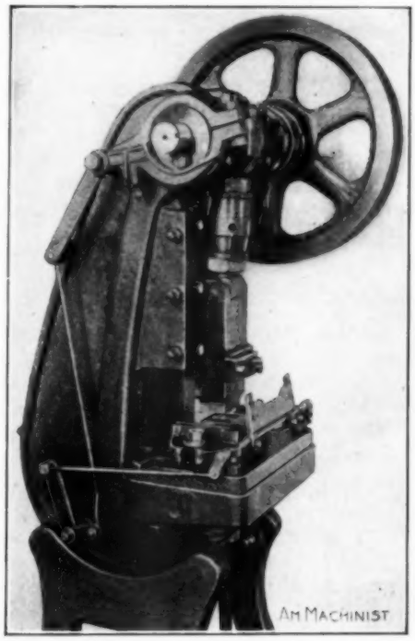


FIG. 2. VIEW FROM OPPOSITE SIDE, SHOWING CAM-OPERATING LEVERS

in Fig. 2 it is shown raised to its full height, the length of travel of the cam roller on the upper operating lever being such that the guard remains up till the punch has fully entered the die.

FIG. 1. PUNCH-PRESS SAFEGUARD

Oxyacetylene Metal-Cutting Machine

A new metal-cutting machine using the oxyacetylene flame is shown in Fig. 1. This machine is built by the Davis-Bournonville Co., New York, N. Y., and is known by the trade name "Oxygraph." It is on the principle of the pantograph. The operation is as follows:

A drawing is made twice the size of the finished work. This drawing is laid on the tracer table. The tracer is mechanically propelled at a uniform speed to give the greatest efficiency and is driven by an electric motor attached to the head of the machine. Power is supplied to the motor either from a storage battery or by a wire from an electric light socket.

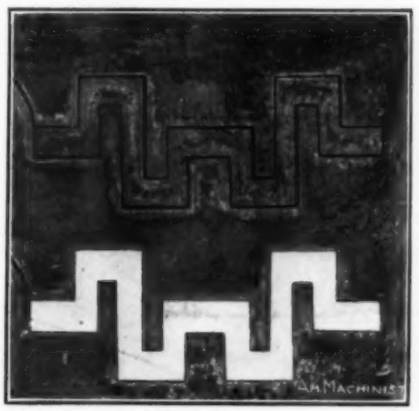


FIG. 2. CRANKSHAFT 51 IN. KERF CUT IN 8½ MINUTES

The operator guides the self-propelling tracer along the lines of the drawing, and the oxyacetylene torch cuts an exact reproduction of these lines in the steel. This reproduction is half the size of the drawing. Steel three inches thick, and less can be cut at the rate of 6 in. per minute.

The apparatus consists of a heavy cast standard and base for supporting the machine, supports for the work while being cut, the tracing table, motor-propelled tracer, machine cutting-torch and hose

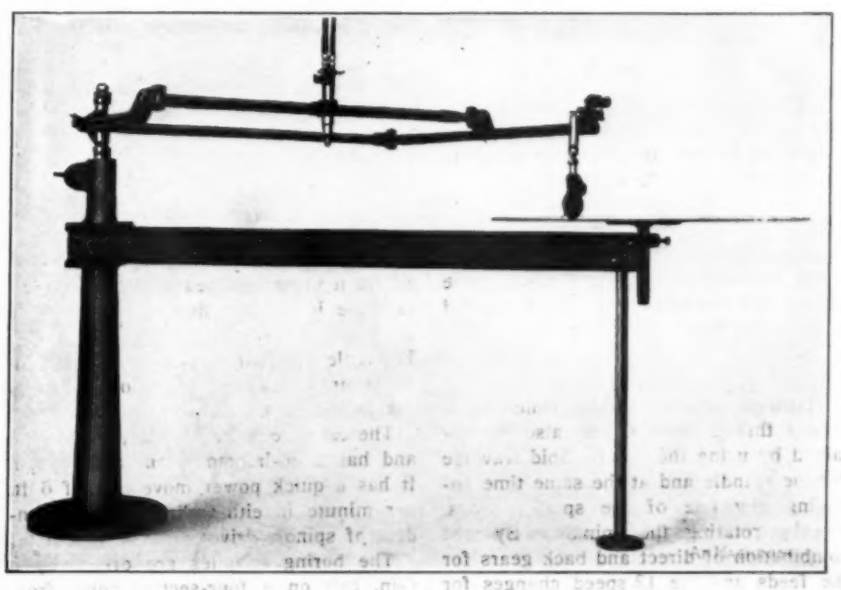


FIG. 1. OXYACETYLENE METAL-CUTTING MACHINE

connections therefor, an oxygen, and acetylene regulator, either high or low pressure, as desired. It can cover forms 18 in. across, and this can be increased by moving the piece being cut.

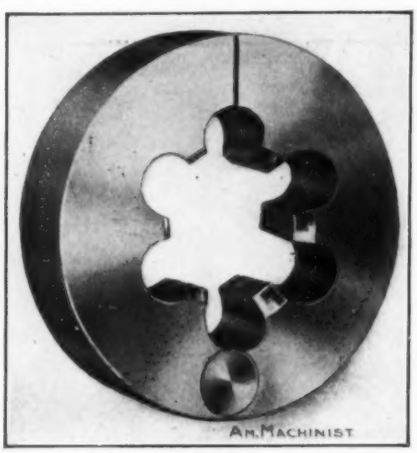
The crankshaft shown in Fig. 2 was cut from inch steel plate in 8½ minutes. For removing the surplus metal in dies, which is usually done by drilling, this machine should prove very efficient as the kerf is very narrow and the cuts clean and sharp.

Adjustable Screw Cutting Die

This die is constructed in two parts, with a heavy, rigid hinge formed integral with one side. The taper hole at the top of the die provides for the reception of the tapered point of the adjusting screw in the die holder. Adjustment for expanding or contracting the die is thus accomplished without removal from the holder.

The cutting surface is ground after tempering and there is sufficient clearance for sharpening with emery wheel or diamond-powder lap.

This die is a recent product of Edgar T. Ward & Sons, Boston, Mass., and is known as the "Remington."



ADJUSTABLE SCREW-CUTTING DIE

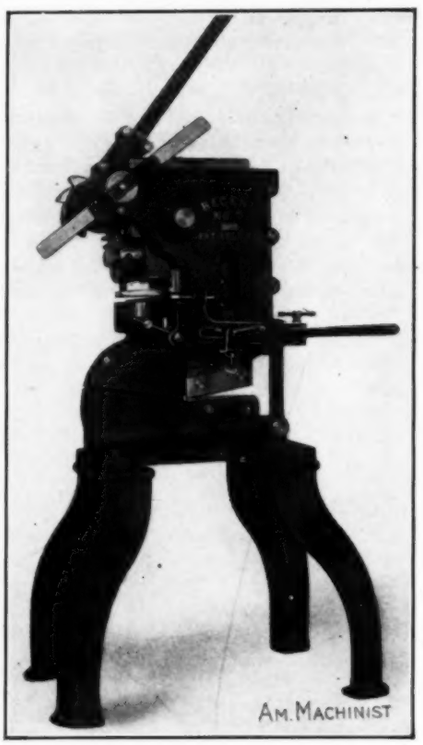
Punch, Shear and Rod Cutter

The halftone shows a punch, shear and rod cutter recently developed by P. G. H. Bennet & Co., Boston, Mass.

It is hand-operated and made in three sizes. The shear is located under the shaft and when the plunger is at its highest position the shear blades overlap each other and thus act as a guide to insure cutting a straight strip or sheet. The wire cutter is located below the pressure shaft. The wire-cutter blades are laid in recesses and are easily removable.

The disks hold four different sizes of punches and dies, the sizes regularly supplied being ⅜, 5/16, ¼ and 3/16 in. The plunger has a large bearing surface which tends to insure correct alignment of the punches and avoid punch breakage.

The machine is equipped with a combination punch and wire gage which enables a row of equally spaced holes to be made an equal distance from the edge of a sheet without the use of a prick punch.



PUNCH, SHEAR AND ROD CUTTER

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

The Crane Co., manufacturer of pipe fittings and brass goods, 399 Atlantic Ave., Boston, Mass., is having plans prepared by Densmore & LeClear, archs., 88 Broad St., Boston, for the construction of a new five-story factory, 80x130 ft.

The Lynn Gas & Electric Co., Lynn, Mass., has awarded the contract for the erection of a three story brick and concrete machine shop on Gas Wharf Road.

The Charles Buck Edge Tool Works, Millbury, Mass., has been reorganized and will install new equipment to increase the output of the plant. James C. Ryder is Pres.

Permits have recently been approved by the Building Department of Somerville, Mass., for the construction of two public garages in that city. One is to be conducted by Jameson Bros. and the other by D. L. Downey. Each is estimated to cost about $10,000.

The Worcester Pressed Steel Co., Worcester, Mass., has had plans prepared for the construction of a new steel mill to be erected at its plant at Barbers Crossing. It will be of concrete, 100x100 ft., one story high. John W. Higgins is mgr. Noted June 6.

The Worcester Machine Screw Co., Beacon St., Worcester, Mass., has begun work on an addition which will double the capacity of its plant. The new building will be 62x150 ft., of brick, mill construction, three stories high.

Ellis F. Stenman, formerly master mechanic for the Morgan Spring Co., Worcester, Mass., has organized the Stenman Wire Goods Specialties, Inc., and will equip a factory at 33 North Foster St., Worcester.

The Miller Wire Cloth Co., Worcester, Mass., has enlarged its factory and will double its capacity in the near future.

The Barker Auto Co., Hartford, Conn., will erect a commercial garage, 60x100 ft., on Riverside Ave., Bristol, Conn.

Homer H. Judd and James H. Davis, of Bristol, Conn., have approved plans for a 100x80 ft. garage, one-story high, of brick and concrete construction.

C. G. Bostwick, 10 Hoodley Place, Hartford, Conn., manufacturer of sheet metal, will erect a four story addition, 38x81 ft., to his factory.

Plans are being prepared for a brick garage to be erected on Freeland St., Torrington, Conn., for the Torrington Repairing Co. It will be 56x58 ft., one story and basement.

Bids are being received for an addition to the machine shop of the Waterbury Farrel Foundry & Machine Co., on Bank St., Waterbury, Conn. It will be of brick, 60x180 ft., one story high. Noted June 6.

MIDDLE ATLANTIC STATES

Fire damaged the plant of the Albany Foundry & Nickel Plate Co., Albany, N. Y., to the extent of $100,000.

The Shuttleworth Brass Co., Amsterdam, N. Y., is receiving bids for the construction of a new mill. It will be one-story, 150x28 ft., and will be erected at the foot of Elk St.

Plans have been prepared by Colson & Hudson, archs., 35 Dun Bldg., Buffalo, N. Y., for the construction of a garage, 24x31 ft., for C. Lee Abell, Chamber of Commerce Bldg.

Bids are being received by Colson & Hudson, archs., Buffalo, N. Y., for the construction of a machine shop for the Howard Iron Works, Chicago, St. It will be one story, 55x182 ft. The estimated cost is $13,000.

The Merritt Mfg. Co., machinists, Lockport, N. Y., has had plans prepared for the construction of a three-story factory at Market St. and the Canal Race.

The Holub-Dusha Co., machinists, 1799 First Ave., New York, N. Y., has purchased property on Washington Ave., between Academy St. and First Ave., on which it will erect a large machine shop.

John M. DeFreest, Lakewood Place, Troy, N. Y., will soon start work on the construction of a one-story garage, 38x60 ft.

The Automatic Starter Co., St. Louis, Mo., recently incorporated with a capital of $50,000, will build a factory in St. Louis, for the manufacture of automobiles. John J. Cochran and H. C. Whitehill are interested.

Martin Bros., Belleville, Ill., are contemplating the establishment of an iron foundry at Paragould, Ark.

J. M. Wilson and H. C. Ruth, San Antonio, Tex., have purchased a site at Castro St. and the International & Great Northern R. R., and will erect a shop to be used for the manufacture of boilers, steel tanks and plate steel work of all kinds. It will be 60x100 ft.

WESTERN STATES

A. W. Hessen & Co., Elko, Nev., are erecting a large garage. James Warden is mgr.

The Lamb Machine Works, Levee St., Hoquiam, Wash., is building a two-story addition to its factory. Frank H. Lamb is pres.

George W. Perry, Hillyard, Wash., will erect a commercial garage and machine shop on Everett Ave., Hillyard.

The Columbia Electric Co., Seattle, Wash., is planning to increase the capacity of its plant for manufacturing electric fixtures and steel cabinets.

John J. Ehlinger, 1027 Eighth Ave., Spokane, Wash., is planning the erection of a commercial garage and repair shop on Second Ave., Spokane. Keith & Whitehouse, Spokane, are preparing plans.

The St. Helens Auto Co., St. Helens, Ore., is constructing a 30x60 ft. garage, which will include a repair shop and a vulcanizing plant.

CANADA

Fire destroyed the engine room of the Peck Rolling Mill, Montreal, Que., on June 5. Loss, $15,000.

Daniel McKenzie, Guelph, Ont., is contemplating the erection of a factory for the manufacture of machinery and tools.

The Electrical Specialties Co., London, Ont., has plans prepared for the construction of a factory. The estimated cost is $25,000.

The Capital Wire Cloth & Mfg. Co., Ottawa, Ont., is erecting a factory at Ottawa. It will be of silicate brick.

The Canada-Ohio Motor Car Co., Port Colborne, Ont., will erect an automobile factory, 60x400 ft.

The Canada Foundry Co., Toronto, Ont., has had plans prepared for the construction of an ornamental iron foundry. The estimated cost is $100,000.

The Detroit Lubricator Co., Detroit, Mich., will erect a branch plant in Windsor, Ont.

The Nova Scotia Car Works, Halifax, N. S., is planning the construction of a car manufacturing plant in Port Arthur. The estimated cost is $5,000,000. F. B. McCurdy, Halifax, is interested.

NEW INCORPORATIONS

METAL WORKING

The following companies have been incorporated to manufacture:

The Rogers Electric Laboratories Co., Augusta, Maine; to manufacture electrical machinery and appliances. Capital $100,000. Incorporators: A. A. Downs, and Henry H. Sawyer.

The Walden Appliance Co., Kittery, Maine; to manufacture machinery and appliances. Capital $100,000. Incorporators: Charles D. Burrage, Needham, Mass., and Horace Mitchell.

The V-C Motor Truck Co., Kittery, Maine; to manufacture all kinds of automobiles, supplies, etc. Capital $100,000. Incorporators: C. E. Smothers, and Horace Mitchell.

The Torsion Nut-Lock & Washer Co., Boston, Mass.; locks, bolts, washers. Capital $50,000. Incorporators: Wm. F. Stodder, and Joseph A. Harris, 6 Beacon St., Boston.

The Vinette Hose-Cock Co., Pittsfield, Mass.; to manufacture fire extinguishers. Capital $50,000. Incorporators: Louis A. Merchant, Michael H. Condron and Edward Gain.

The Non-Destructible Tire Protector Co., Brooklyn, N. Y.; automobile tire protectors. Capital $25,000. Incorporators: Marton Pelz, 849 Willoughby Ave., Brooklyn; Wm. Weiner and Herman Seufert.

The Scientific Equipment Co., Brooklyn, N. Y.; scientific instruments and supplies. Capital $20,000. Incorporators: Carola B. Louis, Alice Court and Leon A. Whitney.

The Standard Meter Co., Brooklyn, N. Y.; water meters, etc. Capital $400,000. Incorporators: J. A. Ross, J. Hobran, Jr. and R. J. Doyle, New York.

The Brooks Motor Car Co., Buffalo, N. Y.; automobiles. Capital $100,000. Incorporators: H. G. Rechtsteiner, G. B. North and E. O. Kerr.

The Hoffman Allan Co., Buffalo, N. Y.; machinery. Capital $500,000. Incorporators: Wm. M. Hoffman, 25 Galatin Ave., Buffalo, N. Y.; Frank B. Allan and Geo. R. Copping.

The Losch Patents Mfg. Co., Borough of Manhattan, N. Y.; machinery, tools, patented articles, etc. Capital $10,000. Incorporators: Charles Losch, 802 Lexington Ave., New York City; Benj. M. Deerson and Robt. Loudon.

Standard Gramophone Appliance Co., Borough Manhattan, N. Y.; gramophone appliance and other novelties. Capital $5,000. Incorporators: James A. McNelus, 404 Sixth Ave., Brooklyn, N. Y.; Chesleigh H. Briscoe and Grarville Whittlesey.

The Emdeca Co. of America, Borough Manhattan, N. Y., metal sheets for decorative purposes. Capital $5,000. Incorporators: Edgard Josz, 2 Rector St., New York; Geo. C. Beach and William W. Mamford.

Newark Typesetting Co., 9 Campbell St., Newark, N. J.; printing type. Capital $50,000. Incorporators; Edward J. Delaney, 49 Sterling St., Newark, N. J.; Jos. F. Reilly and Wm. H. Wallace.

The Tennessee Implement Mfg. Co., Springfield, Tenn.; farm rollers. Capital $10,000. Incorporators: D. F. Williams, H. T. Annis and T. M. Woodard.

The Hadfield Rubber Co., Akron, Ohio; rubber making machinery. Capital $10,000. Incorporators: John Hadfield, Hugh R. Hadfield and Maud M. Hadfield.

The Gripclaw Hammer Co., Cleveland, Ohio; mechanical devices. Capital $10,000. Incorporators: Donald McBride, M. A. Hinschillwood and C. C. Owens.

The Buckeye Brass & Mfg. Co., Cleveland, Ohio. Capital $20,000, manufacturing in brass and other metals. Incorporators: David M. Strauss, Harry Sulker, George J. Allmendinger, B. J. Sawyer and Albert Strauss.

The Standard Automatic Machine Screw Co., Cleveland, Ohio. Capital $25,000. General line of machine manufacturing. Incorporators: J. H. Murphy, Helen Williams, M. J. Gleason, M. M. Gleason and Edward Burke.

The Automatic Tile Mfg. Co., Cincinnati, Ohio. Capital $10,000. Tile machinery. Incorporators: A. W. Koch, E. Friehmelt, William Kachert, Catherine F. Kachert, and F. J. Overbeck.

The Automatic Gas Safety Valve Co., Clyde, Ohio; safety valves for machines. Capital $10,000. Incorporators: L. I. Cleveland, A. F. Gerber and A. E. Culbert.

The National Steam Heater Co., Dayton, Ohio; heaters. Capital $50,000. Incorporators: James Sanders, Karl F. Deal and Joseph Meyer.

The Portsmouth Engine Co., Portsmouth, Ohio. Capital $30,000. Castings and machinery. Incorporators: H. B. Campbell, W. D. Puckett, John E. Rapp, J. A. Lowry and L. C. Turley.

The Chase-Dunipace Co., Toledo, Ohio. Capital $20,000. Machinery. Incorporators: James L. Chase, Joseph E. Dunipace, O. A. Chase, Eugene Rheinfrank, and Harriet Dunipace.

The Abrams-Orton Mfg. Co., Wadsworth, Ohio; heating appliances. Capital $18,000. Incorporators: John A. Abrams, H. L. Orton and William Bolich.

The National Engine & Mfg. Co., Youngstown, Ohio; engines. Capital $25,000. Incorporators: W. J. Sheldon, C. F. McLaughlin and H. R. Greenlee.

The Indiana Machine & Wire Co., Indianapolis, Ind.; wire fence. Capital $30,000. Incorporators: G. W. Whittington, F. H. Irwin and M. F. Cox.

The A. D. W. Automatic Shoe Cleaner Co., Detroit, Mich. Capital $50,000. Patented shoe polishing machine. Incorporators: A. D. Washington, John Holly and B. Estes.

The M-C-B Co., Chicago, Ill.; railway supplies and devices. Capital $5,000. Incorporators: Walter E. Marvel, Frank A. Buckley and Stephen C. Knight.

The Detmer Manufacturing Co., Chicago, Ill.; electrical supplies. Capital $20,000. Incorporators: M. J. Detmer, Wm. Bader, John E. Waters, Chamber of Commerce Bldg., Chicago, Ill.

The National Car Coupler Co., Chicago, Ill.; railway supplies. Capital $300,000. Incorporators: Chas. R. Milford, John P. O'Shaughnessy and Walbeer B. Weston.

The Scientific Auto Tube Co., Chicago, Ill. Capital $20,000. Automobile machinery. Incorporators: Ralph E. Crusen, Howard W. Lewis and Herchel V. Shepard.

The Detmer Mfg. Co., Chicago, Ill. Capital $25,000. Acetylene machines. Incorporators: M. J. Detmer, Louis C. and Wm. Bader.

The Automatic Starter Co., St. Louis, Mo. Capital $50,000. Automobile starters. Incorporators: John J. Cochran, William Ramsey and H. C. Whitehill.

GENERAL MANUFACTURING

NEW ENGLAND.

The Wakefield Slipper Co., recently incorporated at Lynn, Mass., and equip and start a factory at Sanbornville, N. H.

The Ideal Coated Paper Co., Brookfield, Mass., has purchased additional factory space and will increase its capacity.

The Fitchburg Enamel Co., Fitchburg, Mass., will erect a frame addition 50x30 ft., one story high, at 26 Lunenburg St.

The Gardner Gas, Fuel & Light Co., Gardner, Mass., will construct an addition to its plant.

The Ipswich Mills, 165 B St., South Boston, Mass., manufacturers of hosiery, will erect a two-story mill in addition to its plant, to cost $55,000. Lockwood, Greene & Co., Boston, Mass. are the engrs.

James Hancock, Washington St., Hudson, Mass., is at the head of a new company which will manufacture ring spinners. A factory 75x300 ft. will be erected.

The Punctureproof Tire Co., Ludlow, Mass., has purchased about 20 acres near Wood Pond, and will erect a new factory for the manufacture of tires. E. S. Stevenson, Boston, is interested.

The United States Envelope Sealing Co., Springfield, Mass., recently formed, has purchased a site and will have plans drawn at once for the erection of a factory in North Amherst. M. Fuller is secy.

The city of Springfield, Mass., has voted $18,000 for the construction of a garbage reduction plant and $14,000 for a rubbish disposal plant.

The S. O. Bigney Co. has been incorporated in Worcester, Mass., to manufacture jewelry. The home office will be in Worcester and a plant will be erected in Attleboro, Mass.

Fire, in the building occupied by the D. E. Black Co., manufacturing jewelers, 113 Point St., Providence, R. I., caused considerable damage to machinery.

Fire destroyed the power plant of the Connecticut Contracting Co., New Britain, Conn., causing a loss of $8,000. An engine, dynamos, two boilers and three motors were destroyed.

The plant of the Stamford Supply Co., Stamford, Conn., was damaged by fire, June 10. Loss $10,000.

Griggs & Hunt, archs., 51 Leavenworth St., Waterbury, Conn., are preparing plans for the construction of a new factory on State St. for A. C. Campbell, 65 Bank St. It will be three stories high, 32x126 ft., of mill construction.

Frederic N. Perry & Sons, proprietors of the Waterbury Steam Carpet Beating Co. and the City Steam Laundry & Dye Works, Waterbury, Conn., will have plans drawn for two new buildings to be erected on South Main St. A three-story brick and concrete laundry, about 60x100 ft., and a smaller building, 40x40 ft., will be erected. Noted June 13.

MIDDLE ATLANTIC

The Buffalo General Electric Co., Buffalo, N. Y., has filed plans for the construction of a $25,000 power house at 117 East Swan St.

Plans for the new factory of the Mohawk Silk Fabric Co., Fultonville, N. Y., have been completed and bids will soon be received for the construction work.

The refining plant of the Zinsser Chemical Works, Hastings-on-Hudson, N. Y., was destroyed by fire, June 11. Loss, $60,000; insurance, $93,460.

Fire, on June 8, entirely destroyed the fur factory of Whitman & Graham at 406 Manhattan Ave., Williamsburg, New York, N. Y. The building was a three-story, frame structure and the damage is estimated at $30,000.

The Borden Condensed Milk Co., 108 Hudson St., New York, N. Y., is considering plans for the construction of a tin plant at Norwich, N. Y., for the manufacture of tin cans.

The Shredded Wheat Co., Niagara Falls, N. Y., is having plans prepared for the construction of an addition to its plant on Erie St.

The Central Clay Products Co., North Tonawanda, N. Y., which was recently incorporated, has had plans prepared for the construction of a brick manufacturing plant at Beach Ridge. Ten buildings will be erected and equipped. The estimated cost is $35,000.

The sawmill of George Cochran at Shepard's Corners, N. Y., was burned, June 10. Loss, $2000.

Fire, on June 9, destroyed the planing mill of A. W. Booth & Bro., Bayonne, N. J., causing a loss of $250,000.

The city of Bayonne, N. J., is planning the erection of a large soap and oil refinery in the Bergen Point section.

The Federal Laundry Co., 10 South Third St., Camden, N. J., will have plans prepared for a laundry to replace the one recently destroyed by fire. It will be of brick, three stories, 75x90 ft. Estimated cost is $40,000. F. S. Rodam is pres.

The Collings Carriage Co., Inc., 108 North Front St., Camden, N. J., will build a new three-story brick factory, equipped with a small private power plant.

Bids are being received by the Whitney Glass Works, Glassboro, N. J., for the erection of the portion of the plant that was recently destroyed by fire. It will be of structural steel and galvanized sheet iron, 60x125 ft., and cost $25,000. George D. Whitney is pres. Noted June 13.

Peter Wendel, manufacturer of carriages, 142 Waverly Ave., Newark, N. J., has secured a permit to construct a new wagon factory at 171 Badger Ave. It will be one story high, 75x150 ft., of brick.

The Bangor Silk Knitting Co., Bangor, Penn., has started construction on an addition to its mill which will be 37x38 ft. The new structure will be used as an engine room, boiler house and dye-room.

Bids are being received by the England-Walton Co., tanner, 322 Vine St., Philadelphia, Penn., for the construction of a new $100,000 addition to its plant. The new structure will be six stories high, 63x80 ft.

Bids are being received by the Hale & Kilburn Mfg. Co., 18th and Lehigh Aves., Philadelphia, Penn., manufacturer of car seats, furniture, etc., for an additional building to be erected of brick and reinforced concrete, four stories in height. Averill & Adams, Union Trust Bldg., Washington, D. C., are the archs.

The pork packing plant of J. M. Denhoim Bros. & Co., Fifth and Frankstown Aves., Pittsburgh, Penn., was damaged by fire, June 7. Loss, $5,000.

Hain Bros., manufacturers of hosiery, Wernersville, Penn., are receiving bids for the construction of a new factory. It will be three stories high, 38x70 ft.

The building at 306 West Baltimore St., Baltimore, Md., was damaged by fire, June 8. The losses are estimated as follows: J. Leopold & Co., crockery dealers, $25,000: Kirson & Co., manufacturers of clothing, $15,000; Morganstern & Reiser, manufacturers of pants, $10,000.

The plant of The F. X. Ganter Co., manufacturer of show cases and billiard tables, Stockholm St., Baltimore, Md., is to be enlarged, and new equipment installed.

The factory at Bayard and Carroll Sts., Baltimore, Md., has been leased to Wolf & Weiler, manufacturers of underwear, who will equip the factory with all the necessary machinery.

SOUTHERN STATES

The Riverside & Dan River Cotton Mills, Danville, Va., are having plans and specifications prepared by Lockwood, Greene & Co., Boston, Mass., for a new mill, 500x50 ft., three-stories with basement, and a two-story weave shed 400x300 ft.

The Merchants' Cold-Storage & Ice Mfg. Co., Richmond, Va., will erect a five-story cold-storage plant, 130x120 ft., to cost $250,000.

The J. G. Russell Co., Dayton, Ohio, has been awarded the contract for installing an electric light-plant at Graham, W. Va.

The Armour Fertilizer Works, Chicago, Ill., the fertilizer manufacturing branch of Armour & Co., will establish a branch factory at Greensboro, N. C. ing Cost, $250,000.

The Snow Camp Woolen Mills in South Alamance County, near Greensboro, N. C., were totally destroyed by fire, June 10. The loss is partially covered by insurance.

The Rosman Tanning Extract Co., which recently incorporated at Rosman, N. C., will erect a large plant in that city.

The Princeton Cotton Mill Co., Salisbury, N C., will erect a new brick building, 50x224 ft.

The South Atlantic Sugar Refining Corporation, Charleston, S. C., which has been incorporated with $8,000,000 capital stock, plans to build a large refinery.

The Kershaw Cotton Mills, Kershaw, S. C., have been incorporated with $200,000 capital to build a cotton factory.

The N. S. Tire Co. will erect another plant at Atlanta, Ga.

The Empire Cotton Oil Co., Atlanta, Ga., will erect a cotton seed oil mill at Madison, to cost $100,000. Noted June 5.

The Athens Pottery Co., Athens, Ga., will make improvements to its plant.

The City of Cartersville, Ga., will extend its gas plant. Cost $8,000.

The city of DeLand, Fla., will erect a new packing plant at a cost of $7,000. A. S. Hall, Jacksonville, is in charge.

W. W. Wright and others will build a grain elevator at Orlando, Fla.

The Opelika Oil & Fertilizer Co., Opelika, Ala., will enlarge its plant.

The Louisiana Forest Products Co., Bogalusa, La., will erect several plants for the production of turpentine. Cost $250,000.

The Decherd Mill Co., Decherd, Tenn., will install a small lighting plant. C. E. Murray is in charge.

The Tennessee Eastern Electric Co. has been incorporated with a capital of $1,650,000 and will erect a large electric light and power plant at Johnson City, Tenn.

Houston & Liggett, Lewisburg, Tenn., will install woodworking machinery at their Columbia, Tenn., plant.

A large wood-working plant will be installed at Carthage, Tenn., by the J. C. Bilbrey Spoke Co., Livingston, Tenn. Roscoe McGinnis is in charge.

The city of Livingston, Tenn., will erect a gas plant.

The J. C. Bilbrey Spoke Co., Livingston, Tenn., will erect a mill at Carthage, Tenn.

The Ford Flour Co., Nashville, Tenn., will erect an addition to cost $40,000.

B. J. Morrow, of the Pendergast Lumber Co., Pendergast, Tenn., is organising a $100,000 company for the purpose of erecting a large cotton mill.

The Rockwood Mills, Rockwood, Tenn., are having plans and specifications for a new mill prepared by Lockwood, Greene & Co., Boston, Mass., for a two-story with basement building, 200x250 ft.

C. R. Payne, Burkesville, Ky., will install a small lighting plant.

The Frankfort Water Co., Frankfort, Ky., will receive bids for a new filtration plant soon.

The erection of a large stave mill is contemplated by the Kentucky Tie & Stave Co., Harlan, Ky. W. L. Taylor is asst. gen. mgr.

The handle plant of Tinsley & Quiggins, Kuttawa, Ky., was damaged by fire June 3, with a $6,000 loss. Plans for rebuilding are being made.

J. F. Hillerich & Sons Co., Louisville, Ky., which manufactures baseball bats, has purchased the business of the Pontiac Turning Co., Pontiac, Mich., and will enlarge its plant in Louisville.

The Crescent Laundry, Louisville, Ky., is considering the installation of additional machinery. Joseph P. McFarland is president.

J. C. Armstrong, New York, N. Y., is organizing a company in Louisville, Ky., for the manufacture of a new explosive. Peyton N. Clarke, Wilbur Hubley and others are interested.

The Turner, Day & Woolworth Handle Co., Louisville, Ky., will erect a plant for the manufacture of hickory handles at London, Ky.

The Henry Vogt Machine Co., Louisville, Ky., is receiving bids for an addition to its power plant

The D. B. Murphy Lumber Co., London, Ky., will install a plant for the manufacture of lumber, cross-ties and staves. A. L. Morgan is pres. and D. B. Murphy, vice-pres.

A. J. Baker and J. H. Mays are erecting a flour mill at Marion, Ky. In addition to power machinery, conveying equipment will be needed.

The Brent Hart Mining Co., Mannington, Ky. is contemplating the installation of a new power plant.

MIDDLE WEST

The Swinehart Tire & Rubber Co., Akron, Ohio, will erect a large new building. New machinery will be installed.

N. T. Sharp, Bridgeport, Ohio, will erect a plant in Norwalk, Ohio, for the manufacture of fireproof building material.

The Farr Brick Mfg. Co., Cleveland, Ohio, will build a new dryer building, 37x104 ft.

Power plant equipment will be required for the large new bakery for the Clark & Chambers Pie Co., Cincinnati, Ohio, which has increased its capital to $50,000.

The Noyes Mfg. Co., Dayton, Ohio, manufacturer of vending machines, has awarded the contract for its proposed power plant.

W. N. Cox, Mason, Ohio, will receive bids on July 8, for heating andv entilating apparatus for a school building.

The Meister Piano Co., Monroeville, Ohio, will erect an addition to its plant.

The Malta Canning Co., Malta, Ohio, canner of fruits, has doubled its capital and will buy new cannery equipment.

The American Gypsum Co., Port Clinton, Ohio, will build a new power plant to cost about $60,000. Noted April 4.

The Moores Lime Co., Springfield, Ohio, has raised its capital to $150,000 and will buy new power plant equipment.

The Toledo Glass Co., Toledo, Ohio, will erect a $350,000 plant on the Lake Shore and the Michigan Southern Ry. tracks. Noted May 22.

The contract has been awarded by the Toledo Cotton Goods Co., Toledo, Ohio, for a two-story and basement factory, 50x100 ft., to cost $25,000.

The Crystal Laundry Co., 838 Broadway, Toledo, Ohio, is building a new $2,000 power plant.

The city of Woodsfield, Ohio, will erect a stogie factory soon.

Power plant equipment will be installed by the Youngstown Candy Co., Youngstown, Ohio, just organized with $60,000 capital. D. L. Clark is mgr.

F. Froelich, Toledo, Ohio, has prepared plans for a lighting plant at Kendalville, Ind.

The laundry of the Guarantee Washing Co., 325 East St. Joseph St., Indianapolis, Ind., was destroyed by fire, June 6. Loss $10,000.

The Kindergarten Toy Co., Indianapolis, Ind. will erect a two-story $6,000 addition, 36x125 ft., to its factory.

C. L. Post of the Postum Cereal Co., Battle Creek, Mich., has announced that the firm contemplates the erection of a plant to cost $1,000,000 at Milwaukee, Wis.

The H. M. Reynolds Mfg. Co., Grand Rapids, Mich., manufacturers of flexible slate shingles, will erect a two story factory, 60x300 ft.

The factory of the Ludington Woodenware Co., manufacturer of clothespins, Ludington, Mich., was damaged by fire, June 7. Loss, $60,000.

The Petoskey Block & Mfg. Co., Petoskey, Mich., will rebuild its factory recently destroyed.

The Werner & Pfleiderer Co. has awarded the contracts for a plant to be erected at Saginaw, Mich., to manufacture bread, biscuit, macaroni, etc.

The paint shop, testing building and a warehouse of the Sheffield Motor Car Co. at Three Rivers, Mich., were destroyed by fire, June 12. Loss $100,000.

The Eclipse Laundry, 7266 Cottage Grove Ave., Chicago, Ill., will build a two-story brick addition.

R. S. Lindstrom is preparing plans for a $10,000 concrete filter plant for the Union Stock Yards & Transit Co., Chicago, Ill.

N. I. Repke, 6515 Cottage Grove Ave., Chicago, Ill., will receive bids for a two-story brick bakery, 35x67 ft.

The Kurth Co., Chicago, Ill., will erect a grain elevator. Plans are being prepared.

The Ralston-Purina Co., Eighth and Gratiot Sts., East St. Louis, Ill., will erect a milling and manufacturing plant to cost $500,000. W. H. Danforth is pres.

Romadka Bros., Grand Ave., Milwaukee, Wis., are erecting a building for Saxe Bros., who will install a bakery and laundry.

The Lava Co. of America, Milwaukee, Wis., is planning a two-story addition, 44x89 ft., at 48 Seventh St., to cost $10,000.

The Jerslid Knitting Co., Neenah, Wis., will erect a three-story brick factory.

D. W. Stanford, North Elkhart, Wis., will receive bids for a storage reservoir for the Walworth Co., North Elkhart.

The flour mill of the Krueger-Lachmann Co. at Neenah, Wis., was burned, June 10. Loss, $15,000, partly covered by insurance.

The Prairie City Canning Co., Prairie-du-Chien, Wis., will erect a three-story building 50x80 ft.

WEST OF MISSISSIPPI.

The city council of Burr Oak, Iowa, has awarded the contract for the construction of a complete waterworks system. The estimated cost is $28,119. Bids were opened May 23.

The Viking Refrigerator & Mfg. Co., Kansas City, Kan., is contemplating the erection of a factory at Atchison, Kan. W. C. Whitcher, Kansas City, represents the company.

The contract has been awarded for the installation of a water system in Louisville, Neb. Noted May 30.

The cotton gin of R. H. Johnson at Casa, Ark., was destroyed by fire, May 24.

The Cartier & Hengstler Co., Ludington, Mich., has secured a site at Camden, Ark., and will erect a box manufacturing and veneering plant.

George H. Greenway, Dallas, Tex., has purchased land north of San Simon, Ariz., and will install a pumping plant.

The National Lumber & Creosoting Co., Houston, Tex., has had plans prepared for the construction of a creosoting plant. The estimated cost is $150,000.

The oil refinery of the Pierce-Fordyce Co., Texas City, Tex., was damaged by fire, June 2. Loss, $35,000.

The planing mill at the Portland Mine on Battle Mountain, near Victor, Colo., was burned, May 30. Loss, about $1,000, covered by insurance.

C. W. Morris, Portales, N. M., will soon commence the erection of a fruit canning plant at Portales.

The Tekoa Steam Laundry Co., Tekoa, Wash., has purchased a site at Tekoa, and will erect a steam laundry plant.

The planing mill of the St. Paul & Tacoma Lumber Co. at Tacoma, Wash., was damaged by fire, June 8. Loss, $250,000.

The Hoselton Saw Mill, near Crow, Ore., was burned May 23. The mill was owned by Henry Canady.

The Consumers' Lumber & Supply Co., Portland, Ore., recently organized, has acquired a site at Burlington Harbor, ten miles below Portland, and will erect a large sawmill plant to cost $100,000. Henry Folz and W. P. Rhoades, Klamath Falls, Ore., are interested.

J. A. Dupuis, Pendleton, Ore., has organized a corporation with a capital of $50,000, for the purpose of erecting a plant in Portland, Ore., for the manufacture of a patented simplex, double-slide, inside swing window.

The new flour mill of Balfour, Guthrie & Co. at Portland, Ore., was destroyed by fire, June 7. Loss, $100,000.

The Gerbhart Broom Co., Chico, Calif., is contemplating the erection of a broom factory at Chico. J. Gerbhart is pres.

The Union Lumber Co., Fort Bragg, Calif., is contemplating the erection of an addition to its mill.

The Purity Bottle Co., Fresno, Calif., is planning the erection of a bottle factory at Fresno.

The Los Angeles Ice & Cold Storage Co., Los Angeles, Calif., will soon begin the erection of an ice and cold storage plant at Brea, Calif.

The White Star Laundry Co., Stephenson Ave. and Merrick St., Los Angeles, Calif., will build a one-story brick addition to its steam laundry. Garrett & Bixby, 405 Currier Bldg., Los Angeles, are preparing plans.

The South Coast Canning Co., Long Beach, Calif., will erect a fish canning plant at 1258 West Third St., Long Beach. H. C. Privett is interested.

H. C. Korbeer, Nevada City, Calif., is planning the erection of a plant at Nevada City for the manufacture of fireless cookers.

The California China Products Co., Seventh Ave., and Twelfth St., National City, Calif., is constructing numerous additions to its plant.

The Board of Trustees, Orange, Calif., has commissioned Mayberry & Parker, engrs., Pacific Electric Bldg., Los Angeles, to prepare plans and specifications for a reinforced concrete pumping station.

Walker Bros., Oroville, Calif., are planning the erection of a large lumbering plant near Oroville.

The Klein-Norton Co., manufacturer of overalls, Los Angeles, Calif., will soon erect a new factory at San Bernardino, Calif.

The Vista Land Co., Redlands, Calif., recently incorporated with a capital of $250,000, has purchased 1900 acres of land at San Diego, Calif. A townsite will be laid out and a water system installed. A. W. Martin is pres.

The Standard Oil Co., San Francisco, Calif., will soon begin the erection, at its refinery at Richmond, Calif., of two new boiler houses, each containing fifteen boilers, two additional units to the acid plant, and other improvements. The work will cost about $2,000,000.

The Standard Biscuit Co., San Francisco, Calif., will improve and enlarge its factory. The estimated cost is $50,000.

CANADA

The contract has been awarded for the construction and equipment of a plant for the Palmer-McClellan Shoepack Co., Fredericton, N. B.

The John Palmer Co., Fredericton, N. B., tanner, is planning the construction of a plant.

N. K. Fairbank, Montreal, Que., manufacturer of lard, oil and soap, is erecting a plant in Cote St. Paul, Montreal.

The St. Maurice Valley Cotton Mills Co., Three Rivers, Que., is planning the erection of a factory.

The Dundas Linen Mills, Iroquois, Ont., recently incorporated with a capital of $100,000, will build a factory. Robert Caldwell is interested.

M. J. O'Brien, Renfrew, Ont., is planning the erection of a large pulp mill near Quinze Lake and Lake Expanse, Northern Ontario. It will have a capacity of 400 tons daily.

Byard Abrams, New Westminster, B. C., will erect a steam laundry at Blackie and Moody Sts., New Westminster.

FOREIGN

Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a.m., July 13, for the construction of a steam driven ice making and refrigerating plant at the naval station at Guantanamo, Cuba. H. R. Stanford is Chief of Bureau.

NEW INCORPORATIONS

GENERAL

The Akeles Mfg. Co., Augusta, Maine; to manufacture foot comfort devices, etc. Capital $150,000. Incorporators: R. S. Buzzell, L. J. Coleman and C. L. Andrews.

Lundin & Co., Augusta, Maine; to manufacture all kinds of merchandise. Capital $1,500,000. Incorporators: E. M. Leavitt and Ernest L. McLe...

T. Yeaton Shoe Co., Auburn, Maine; to manufacture shoes. Capital $10,000. Incorporators: Frank L. Bartlett and W. T. Yeaton.

The Windham Mfg. Co., Windham, Maine. Capital $100,000. Manufacture cloth, yarns, etc.

American Life Saving Garment Co., Boston, Mass. Life-saving apparel. Capital, $25,000. Incorporators: John B. MacSwain and John T. Patcleder.

James Holden, Inc., Fall River, Mass.; yarn. Capital, $25,000. Incorporators: James Holden, Charles H. Cummings and George C. Cummings, all of Fall River.

The J. H. Murray Co., Haverhill, Mass.; to manufacture shoes. Capital $10,000. Incorporators: James H. Murray, G. H. Elliott and Frank Batchelder.

The Bigwood Woolen Co., Spencer, Mass.; woolen goods. Capital, $25,000. Incorporators: Mellen Halbro, Milford, David Bigwood, Bellingham, and Clifford A. Cook, Milford, Mass.

The Continental Film Co., Manhattan, N. Y.; motion picture films. Capital $100,000. Incorporators: Edward G. Ullman, 145 West 45th Street, Harry Wolfe and Abraham Koch,

The Knickerbocker Commercial Vehicle Co., Borough Manhattan, N. Y.; commercial vehicles. Capital, $300,000. Incorporators: E. A. Dillenbeck, 107 West 82nd St., J. B. Williams, 549 Third Ave., and E. A. Smith, 201 West 142d St., New York, N. Y.

National Bottle Cap Co., Borough Manhattan, N. Y., bottle stoppers. Capital, $10,000. Incorporators: A. B. Stupel, 68 East 96th St., New York, Geo. F. Mattuck, and James S. Watson.

The Ideal Picture & Novelty Co., Borough Manhattan, N. Y.; pictures, picture frames and novelties. Capital, $6,000. Incorporators: Frederick A. Miller, 521 West 186th St., Bernard Zolty, 32 West 116th St., and Louis Pollock, 153 West 117th St., New York, N. Y.

E. & Z. Van Raalte, Inc., Borough Manhattan, N. Y.; embroideries, laces and veilings. Capital $1,-

000,000. Incorporators: Van Raalte, 100 Fifth Ave., Zealie Raalte, and George N. H. Clement, 60 Wall St., New York, N. Y.

The Freeman-Sumner Co., Boro. Manhattan, N. Y.; textiles. Capital $50,000. Incorporators: V. E. Freeman, E. Sumner and M. Miller, New York.

The Airyknit Co., Oriskany Falls, N. Y.; knit goods. Capital $100,000. Incorporators: Quentin McAdam, 23 South St., William T. Baker, 410 Genesee St., and Charles B. Rogers, 91 Genesee St., Utica, N. Y.

The United Piece Dye Works, Lodi, N. J.; silk and textile fabrics. Capital $8,000,000. Incorporators: W. R. Rose, N. S. Schloss, 128 Broadway, New York, N. Y., and J. Scholer.

The Newbold Mfg. Co., Newark, N. J.; chemicals. Capital, $250,000. Incorporators: Charles A. Woodruff, E. T. Williamson and James B. Potter, all of Essex Bldg., Newark.

The Mitchell Watchung Silk Co., 152 Park Ave., Plainfield, N. J.; silk and other textile fabrics. Capital $150,000. Incorporators: Thos. J. Mitchell, E. M. Laing, and Wm. R. Codington.

The Burr-Oak Belting Co., Cincinnati, Ohio. Capital $20,000. Belting and mill supplies. Incorporators: D. L. Pierson, W. L. Hallpike, and E. D. Rowe.

The O. & H. Tire Co., East Palestine, Ohio; automobile tires. Capital $50,000. Incorporators: J. A. Oatsden, A. L. Shumate and C. A. Oatsden.

The Independent Electric & Construction Co., Maumee, Ohio; current for light, heat and power. Capital $10,000. Incorporators: N. F. Evans, Leger J. Metzger and Carl J. Lindecker.

The Norwood Sash & Door Mfg. Co., Norwood, Ohio. Capital $100,000. Doors and sashes. Incorporators: Malcolm McAvoy, Henry L. Sturn and F. M. Riggs.

The Piano & Heavy Box Truck Mfg. Co., Toledo, Ohio. Capital $20,000. Piano and heavy trucks. Incorporators: A. T. Raynor, W. F. Runkle, Henry Hoppenberg, James Long and E. M. Hoppenberg.

Youngstown Candy Co., Youngstown, Ohio; candy. Capital $50,000. Incorporators: C. C. Lance, Mary L. Lance, D. L. Clark.

The Zeno Mfg. Co., Indianapolis, Ind. Capital $5,000. Bathroom furniture. Incorporators: S. F. Daily, J. M. Daily and Z. W. Whitney.

The Municipal & Commercial Film Mfg. Co., Indianapolis, Ind.; manufacture films. Capital $20,000. Incorporators: V. E. Bolyard, A. F. Sutton, and C. W. Randall.

The Meridian Heights Cement Block Co., Indianapolis, Ind.; cement blocks. Capital $10,000. Incorporators: W. S. Dow, J. E. Spiegel, and B. F. Swindler.

The Central Tag Co., Chicago, Ill. Capital $40,000. Tags. Delbert A. Clitherd, James H. Dunn and Samuel S. Carr.

Hardwood Lumber and Manufacturing Co., Chicago, Ill. Capital, $10,000. Lumber manufacturing. Incorporators: John L. Burlin, Martin A. Rickert, and Otto C. Dwora.

The Garbet Mfg. Co., Chicago, Ill., household specialties. Capital, $100,000. Incorporators: H. S. Hill, 438 East 45th Place, Chicago, Ill.

The New Fermentation Co., Chicago, Ill., yeast. Capital, $1,000. Incorporators: Henry H. Barnum, George A. Schneider and Nathan R. Walkfield, Jr.

The Los Angeles Dry Battery Co. Capital $25,000. Dry batteries. Incorporators: Fritz Heine, C. Jaeger, C. Pressel and E. E. Morgan.

Forthcoming Meetings

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Institute of Metals (formerly American Brass Founders Association) Annual Convention, Sept. 24, 25, 26, Hotel Iroquois, Buffalo, N. Y. W. W. Corse, Secretary, Buffalo, N. Y.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburgh, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland. Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Canada

MACHINISTS, first class,. Lathe, planer and vertical boring mill hands. In writing, state age, experience and wages expected. Box 454, American Machinist.

Connecticut

SCREW-MACHINE HAND, automatic, experienced on Gridley and Acme machines. Must be first-class. Address Box 4, Norwich, Conn.

Massachusetts

TOOLMAKERS for punch and die work. Write Worcester Pressed Steel Company, Worcester, Mass.

DIE SINKER, first-class, experienced on small follow-up dies; 40c. to 50c. per hour, according to ability; steady work; Boston. Box 355, Am. Mach.

FOREMAN—An old established, well-known New England concern is enlarging its department for making up-set machine screws, both rolled and cut thread, and wishes a competent foreman for same. None but experienced men need apply. Please state experience, references and salary required. All references strictly confidential. No references to present employers without permission. Box 452, American Machinist.

Michigan

ENGINEER AND DRAFTSMAN—A company manufacturing electric cranes wants an experienced designing engineer, one high class structural draftsman, and one general detail draftsman. Applicants must give full information as to former positions, experience and salary expected. Box 447, American Machinist.

By a company located in the middle west, manufacturing hoisting and conveying machinery, a young man with knowledge of shop management and wage systems, also experience in machine shop. Give full details of experience, positions held, references, and salary acceptable to start. A permanent position in good locality is assured the right man. Box 422, Am. Machinist.

New Jersey

TOOL DESIGNERS wanted. Apply Crocker-Wheeler Co., Ampere, N. J.

DRAFTSMAN capable of taking charge of work on machine tools. Box 451, Amer. Mach.

MACHINE HANDS in all departments. Saurer Motor Company, Plainfield, N. J.

FOREMAN, toolroom, expert, by large Eastern concern, with automobile experience. Box 445, Amer. Machinist.

ASSISTANT SUPERINTENDENT—Tool-maker 30 to 35 years of age, in factory located at Newark, N. J., manufacturing pliers, nippers, etc. Must be first-class mechanic and ambitious. State experience, where previously employed, position held, salary expected and whether married or single. Box 420, Am. Machinist.

New York

TOOL AND DIE MAKERS—No labor troubles. Steady employment and good wages to first-class men. Apply to Superintendent, U. S. Light & Heating Co., Niagara Falls, N. Y.

TOOL AND DIE MAKER—First-class, must be able to read from drawings. One who can speak German preferred. Apply in person to Supt. at the Works, American Hard Rubber Co., College Point, N. Y.

DRAFTSMAN—Wanted, layout man. Must be capable man. Not afraid of work. Man with automobile experience preferred. Reply, stating age, experience and salary expected. "Chief Draftsman," U,. S. Motor Co., 3 West 61st St., New York City.

RARE OPPORTUNITY is open to a technically trained mechanic with practical experience in and knowledge of machinery; best suited for man between 25 and 35 years of age who aspires to success in mechanics and machinery lines; experience in the commercial end of machinery would add value; right man can sell his services for full value and probably be repaid by an interest in business. Applicants should furnish full information regarding ability and experience which will be held strictly confidential. Address J. Amaral Castro, P. O. Box 1620, New York City.

Ohio

DRAFTSMAN for machine tool work. Must be first class. Box 458, American Machinist.

RATE SETTER, of at least ten years experience, to take charge of rate setting in premium shop. Box 450, American Machinist.

DIE AND JIG MAKERS—First-class, on high-grade telephone work; state experience and wages. American Automatic Telephone Co., Urbana, Ohio.

MACHINE TOOL SALESMAN, first class, wanted for New England territory; permanent position fo. the right man; none but experienced salesman considered. Box 408, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

TOOL DESIGNER, man with experience in designing and machinery. Reply to "Employment," Box 911, Pittsburgh, Penn.

DRAFTSMEN—Experienced in Corliss engines and general machinery. State experience, reference, salary and age. Robt. Wetherill & Co., Inc., Chester, Pa.

MACHINE HANDS, Acme automatic screw, Gridley automatic screw machine hands, tool makers and coppersmiths. Address P. O. Box 911, Pittsburgh, Penn.

MACHINERY SALESMAN wanted who can sell to the machinery and supply trade. Practical man only wanted. Works located near Philadelphia, Pa. Box 453. American Machinist.

ADVERTISING MAN, opening for, with some knowledge of metal working machinery, and ability to conduct an aggressive campaign as well as to supervise the production of highest class printed matter. Fine chance to become part of a large, firmly established machine tool manufacturing company. Box 428, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Virginia

DRAFTSMAN, Experienced, on heavy bending rolls, punch and shear, and heavy machinery. State experience and salary expected. Covington Machine Company, Covington, Va.

Wisconsin

ASSISTANT SUPERINTENDENT—We want a man capable of taking charge of the productive end of plant manufacturing small high class electrical motors and apparatus. Electrical experience not absolutely necessary, but must be practical mechanic, skilled in designing tools and able to handle men to advantage. State age and experience. Box 432, American Machinist.

Positions Wanted

Connecticut

SUPERINTENDENT—By energetic manufacturing superintendent, good organizer and executive, wide experience on rate setting and quantity production. Now employed. Box 444, Am. Ma.

Illinois

DESIGNER, with experience on machine tools, sheet-metal presses and dies, and on tools, jigs and fixtures, wants responsible position with a manufacturing concern. Box 466, Amer. Machinist.

MECHANICAL SUPERINTENDENT, of 20 years' experience, in machinery manufacturing, tool-making and designing, desires position where he will have larger opportunities than his present position affords. Age 41. American. Reliable and trustworthy; references. Box 456, Am. Mach.

Michigan

ASSISTANT MANAGER, 12 years experience in gasoline engine manufacturing. Can design and build a full line of engines and spray rigs; also have had experience handling sales. Present position, assistant manager. Will consider any good position with progressive company. Good reasons for making change. Best references. Box 462, Amer. Machinist.

New Jersey

DRAFTSMAN, wants extra work. Box 449, American Machinist.

GENERAL FOREMAN or superintendent of manufacturing plant desiring to make a change; 12 years' experience. Box 467, Amer. Machinist.

FOREMAN, 30, practical mechanic and executive; engines and electrical machinery; can install and understands Taylor system. Box 418, Am. Machinist.

FOREMAN, die-casting, thoroughly practical, experienced with all classes of work, would like to locate with some progressive firm. Box 459, American Machinist.

MAN, 41, now employed as factory superintendent, chief of production and tool design in large motor truck company, desires change. Box 431, American Machinist.

GENERAL FOUNDRY FOREMAN, experienced on high grade machine tool, general jobbing, and gasoline engine castings. Am now making the finest semi-steel machine tool castings in New England. Age 39, married, strictly temperate, molding machine experience. Diploma in McGain's system of mixing iron by analysis, cupola practice, and semi-steel. Salary, $3000. Box 426, Am. Machinist.

New York

DRAFTSMAN on jigs and fixtures, etc., desires permanent position. Box 470 Am. Machinist.

TOOLROOM FOREMAN—Expert on dies, designer with up-to-date ideas and A1 references wants to make a change. Box 419, Am. Machinist.

MACHINIST and instrument maker, well acquainted with modern manufacturing, executive ability, open for position. Address "Hustler," Box 468, Amer. Machinist.

FOREMAN 31 years old, A-1 mechanic, 15 years' experience, can produce results, considerable technical education, open for position after July 1st, references furnished. Box 469 Am. Machinist.

SUPERINTENDENT, with several years' experience on high grade machine work under the premium plan, seeks place as assistant to successful superintendent working on the bonus system. Engineering graduate, age 32, energetic. Box 464, Am. Mach.

PRODUCTION MAN, now employed, wants place to stimulate output and quality. Engineering training. Several years' experience in design and manufacture of high grade steam machinery. Can take charge of shop if desired. Box 465, Amer. Machinist.

MECHANICAL ENGINEER, age 29, college graduate, with wide experience in designing and building of light and medium weight machinery, tools, jigs and fixtures. Also practical experience in japanning, nickel plating, hardening and echnical material testing work. Would go where a chance for advancement is given to ambitious man. Western states preferred. Box 455, Amer. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

SUPERINTENDENT, 34; expert in manufacturing at low cost; extensive experience in equipping machine tools for making large variety of parts; successful in introducing simple and practical factory system with large concerns of highest reputation; can lay out plant with idea of taking care of continuous extensions; engaged but desires change, preferably with growing concern manufacturing specialties. Box 407, Am. Machinist.

ASSISTANT SUPERINTENDENT, by technical graduate, 29 years of age; has had seven years' experience as designer in various lines of machine-tools and special automatic machinery; competent tool-designer; well posted on modern shop practice and manufacturing methods, executive ability; references; at present holds position as tool-designer; will make a change if he can secure the right position; location and salary will be secondary considerations. Box 461, American Machinist.

Pennsylvania

EFFICIENCY EXPERT, three years with large manufacturing concern, wants to make a change. Would like to correspond with firms desiring better system and higher efficiency in their shops. Thoroughly practical ideas. Box 446, Am. Mach.

OFFICE MANAGER, now employed, desirous of making change. Able to take charge of stock, purchasing, order and cost departments. Ten years' experience. Thirty-two years of age and married. Box 457, American Machinist.

Rhode Island

WORKS MANAGER or superintendent, 38, I have a proven record of efficiency. Desire large responsibilities that will absorb my extensive experience, energy, perseverance and ambition. I have trained capable assistants. I am thoroughly versed in modern simple office and shop systems that have reduced production costs in both wood and metal. Expert inventor, designer and draftsman. I will make good or pay; find a way or make one. Address "Engineer," Box 463, Amer. Machinist.

Wisconsin

SUPERINTENDENT, up-to-date and a hustler. many years on automatic machinery, expert on high class tool design and interchangeable manufacture, seeks position with progressive concern, East or West. Box 460, American Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

Manufacturer wanted to make calculating machine, including tools and dies. Box 429, American Machinist.

A great opportunity to obtain the right for the manufacture of a well-known patented tachometer. Communicate with Edward M. Meek, 165 Broadway, New York City.

Canadian company, with modern equipment, manufacturers of woodworking machinery, wish to acquire the Canadian right to manufacture one or two high grade wood tools. Box 448, Am. Ma.

Experimental apparatus or anything needing extra good machine shop work and oversight can be economically built at my new laboratory and shop. A. H. Emery, Stamford, Conn. Works at Glenbrook, Conn.

Talks With Our Readers

By The Sales Manager

Another great convention of advertising men—business men—has passed into history.

Like its predecessors, it has written the story of a year's progress and bonded its future performance.

The Associated Advertising Clubs of America have formed the habit of making good their promises.

The eighth annual convention was formally opened in Dallas, Texas, on Monday, May 20, with 2,343 in attendance.

These men represented every section of the United States. San Francisco sent fifty-nine; Boston sent forty. Canada was represented by forty-eight and England had her delegates on the job.

It was international!

They were there to advance the cause of Advertising as an essential factor in the world's work. They were there to create a public sentiment in favor of *honest* advertising, to rip from the hands of charlatans what vestiges of advertising influence they still retained.

They put Advertising one wide step nearer its ultimate goal.

Years ago no publisher ever thought of refusing an advertisement, especially if cash accompanied the order. Today no reputable magazine will take an ad from the patent medicine faker, many of them refuse cigarette and liquor advertising and one woman's magazine, at least, refuses to allow illustrations of steins and such on the ground that the paper reaches the homes of young girls before whom even the suggestion of drink must not be put.

Today the greatest offenders against decency and honor in advertising are the newspapers. They will see the light in time and the spectacle of the managing editor of one of New York's great dailies defending the clap-trap medical stuff, the fortune teller's and the patent medicine ad will seem like some dim spectre arising from the foul bed of an unhealthy morass to be blown away by a public sentiment in favor of clean, honest publicity.

Many newspapers today are exercising vigorous censorship over their advertising columns and one of them, at least, employs an advertising editor whose whole job is to run down and expose advertising fakers. Such a paper can be received into a family with full confidence in the decency of its advertising and the integrity of its editorial matter. It cannot be swayed from truth by the advertisers' pull.

Many years ago the publishers of the "American Machinist" went further than has anybody else so far in declaring that only advertising which "belongs" can be put into this paper. That is to say, the product advertised must be used in and around a machine-making plant. Only recently this concern has refused a watch ad, an automobile ad and a washing powder ad. Each was a good product made by reputable people but none "belongs" in a paper devoted to the *business side* of things.

This is a new era in advertising—a wonderful decade of tremendous advancement.

The world progresses because we are all trying to *sell* the work of our brain and hands. In the doing of it we must move outside the limited circle of our own environment. We must reach into new fields, interest new peoples, rub shoulders with other ideas, and all the time we are absorbing new knowledge.

The aim of Advertising is to do all this more quickly and more efficiently.

The printing press multiplies our messages thousands of times and those forerunners of progress, the railroad and steamship, carry them to the world.

When a man advertises, he puts into black and white his commercial ambitions. The printed page staring up at him week after week makes him live up to his lithographs, else his conscience is a dead thing.

Secrecy and darkness are no longer the signs of potential success.

Clear the road, gentlemen, for more publicity in making and in selling, in publishing and in advertising.

The people want it and the people usually achieve their ends.

* * *

Only reliable products can be continuously advertised.

Methods in a Southern Contract Shop

By John S. Van Pelt

A number of easily made jigs and fixtures which expedite the work and aid in the problem of interchangeability, and which are in use in a shop that is primarily a repair shop, and manufactures only to keep the men busy in the dull season.

The practice of saving time by using time-saving devices and jigs has reached a stage where their use is absolutely necessary, even in a contract shop. We see now jigs, or time-saving devices, in every issue of our trade papers, and still there is an opening for new ones, or ones that are improvements over those now in general use.

The art of designing jigs rests in making them as simple as possible. Jigs should be designed with the idea of using them for only one operation, unless the circumstances permit the simplest kind of a jig for two or more operations, for as they become complicated they lengthen the time for the job.

In contract, or job, shops where it is not profitable to have a special machine for each kind of work, the jig problem is quite a puzzling one, as the number of pieces to be machined is usually not enough to warrant jigs and still competition necessitates their use. Under these conditions the simplest jigs are made, and are seldom used after the job in question has been completed.

In designing a jig of this class it is good practice to make a sketch, study it hard, tear it up. Make another, study it harder, tear it up, and make a third one. Nine times out of ten the third result will be a jig far more simple than the first.

The jigs and devices illustrated and described in this article, which are in use at the Lombard Iron Works, Augusta, Ga., were designed to suit the machines at hand and not with the idea of using the best machine suitable for the job that can be manufactured. The time made, therefore, with these jigs could very likely be beaten under more favorable conditions. In other words, these jigs are intended for job-shop practice and not for manufacturing.

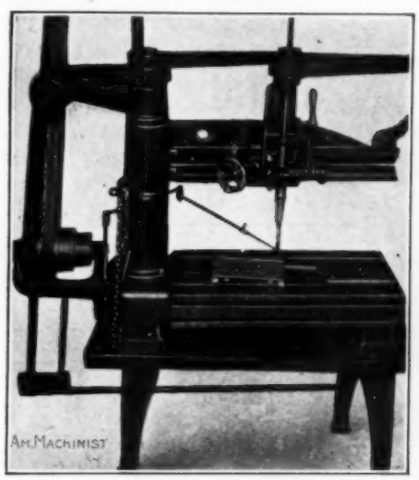


FIG. 1. DRILLER, SPECIALLY LUBRICATED

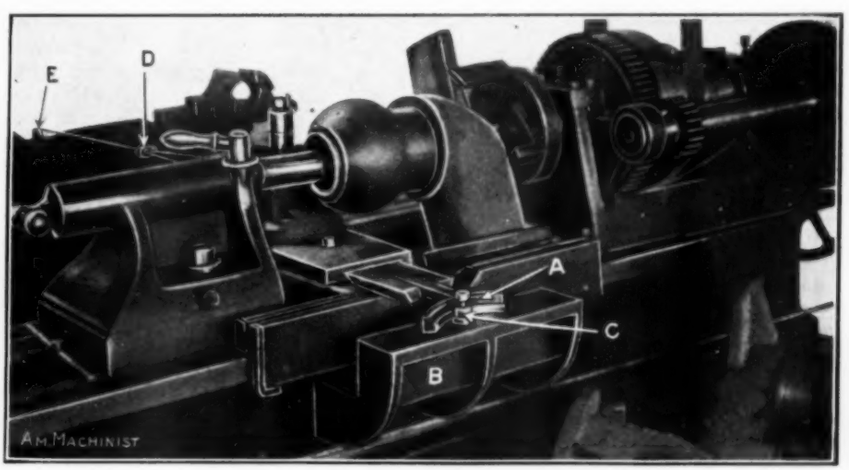


FIG. 2. BALL-TURNING FIXTURE

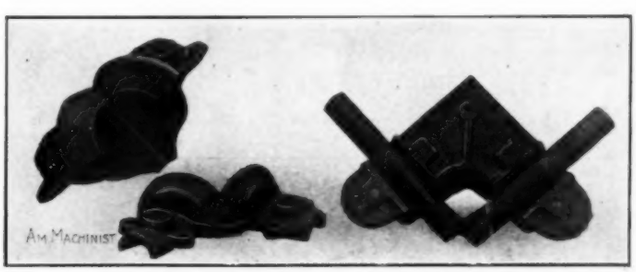


FIG. 3. RIGHT-ANGLED BABBITTING MANDREL

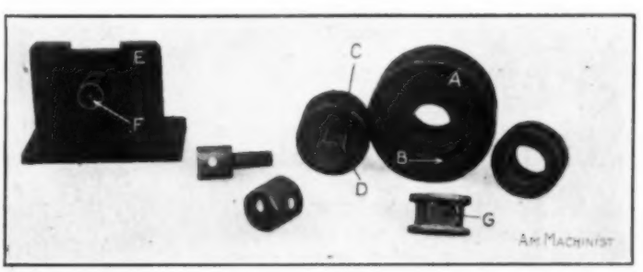


FIG. 4. SET-COLLAR FINISHING JIG

LUBRICATING DRILLS

We get some splendid results from a drilling machine equipped as shown in Fig. 1. This machine is ball bearing all over and the spindle runs at 840 r.p.m. on the highest speed. It was received from the factory as shown, with the exception of the oil pump, piping and oil pan. These were applied in the shop with the idea of keeping the drill under a stream of oil at all times, and proved very successful. By experimenting, however, it developed that a thin drilling compound composed almost entirely of water, with just enough drilling compound added to make the water smooth and prevent the rusting of the machine, would allow greater drill speed and cut the expense of regrinding drills.

The fact that the point of the pipe is placed so as to allow the compound to strike the drill after it is raised clear of the work, cools the point between settings of the jig or work, and while drilling, the compound runs down and keeps both the drill and the work cool.

This machine is supplied with the best high-speed drills that can be obtained and every make was given a fair trial until the best was found.

DRILLING CONVEYOR COUPLINGS

On the drill table is a jig for drilling conveyor couplings, used to couple spiral, cotton-seed conveyors. This coupling is 1½x12 in., and has four $\frac{13}{32}$-in. holes drilled through it, one pair being at right angles to the other two. The jig is a plain square casting, exactly the length of the coupling, and has four hardened tool-steel bushings to guide the drill.

The bushings are ¾ in. in length, as longer ones choke up. When the first hole is completed, a pin is placed in it to prevent shifting. The time required to put in a coupling, drill the four holes through the six inches of steel, and start to put in another coupling, is four minutes.

The casting has a lug cast on it for the live center and a cathead is used for a dead center. One man can machine six in a day. The size of the casting can be judged when it is known that the lathe swings 25 in. and that the casting pattern had to be trimmed to allow it to miss the ways.

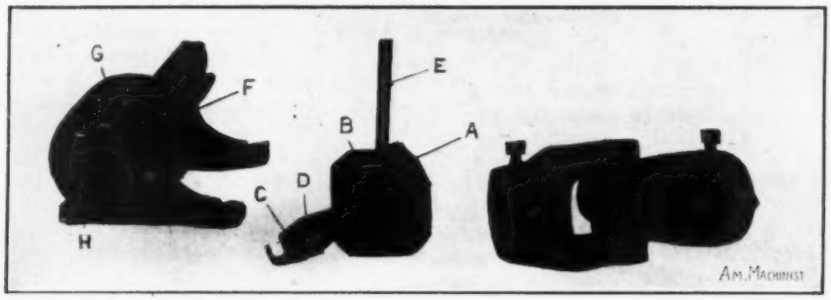


FIG. 5. JIGS FOR UNIVERSAL COUPLINGS

Making 150 couplings with one single spindle in a 10-hour working day is possible, but a loss of 25 couplings a day is due to the operator stopping to oil the machine, getting water, and changing drills, bringing the actual output down to 125 per day.

The couplings are cut off in a Jones & Lamson lathe at the rate of one every 20 seconds, cutting time, or one every minute for the whole day. A good man can cut off between five and six hundred every day, counting putting in new bars, and changing and sharpening tools. Counting 500 per day with a $2 man, makes one coupling cost two-fifths of a cent to cut off; 125 drilled by a $1 boy, cost four-fifths of a cent each, and adding two-fifths of a cent for handling from warehouse to customer makes each coupling cost 1⅘ cents more than the material used. The old method cost the company four cents to manufacture the same coupling, or 2⅖ cents more, which means a saving of $120 on 5000 pieces.

BALL-TURNING FIXTURE

A fixture used for turning the ball end of a universal hydraulic mining nozzle is shown in Fig. 2. A circular piece *A* is shown bolted to the bracket *B* of the regular taper attachment. This circular piece acts as a guide for the roller *C*, on the end of a bar bolted to the cross-slide.

The crossfeed nut is loosened and a wire cable is attached to the crossfeed handle, as shown at *D*. This cable runs over a little pulley *E* and has a heavy weight on the end, which holds the roller hard against the circular guide at all times. The tool must be placed with the cutting point exactly even with the center of the lathe and also placed to start the cut when the roller is at the starting point on the circular piece; otherwise, a different radius than the required one will be turned.

A BABBITTING JIG

A very cheap babbitting mandrel used to babbitt right-angle drive frame bearings, is shown in Fig. 3. The mandrel is turned 0.008 in. larger than the required size, sawed half through, heated and bent to 90 deg. as shown. Four set collars are placed on the mandrel so as to hold it square and also to keep in the melted babbitt. The bearings require no scraping, as the oversize mandrel saves this. It will be noticed from the halftone that the caps are made in one piece and have safety hoods to cover the gears.

SET-COLLAR JIGS

A number of set-coller jigs are shown in Fig. 4. The collars are first held in the chuck *A*, which fits the lathe spindle,

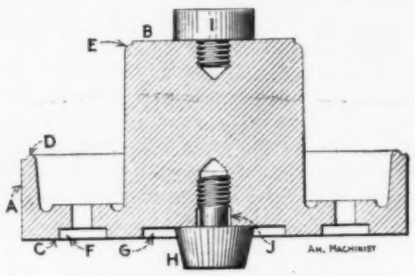


FIG. 6. PATTERN FOR FLANGED COUPLING

and are bored out. This chuck has an eccentric slot in it at *B*, in which a roller is placed to lock the collar, and the heavier the cut the tighter is the collar held.

Next the collars are slipped over a plug jig *C*, which is screwed onto the lathe spindle in the same way as the boring jig. The work is locked by an

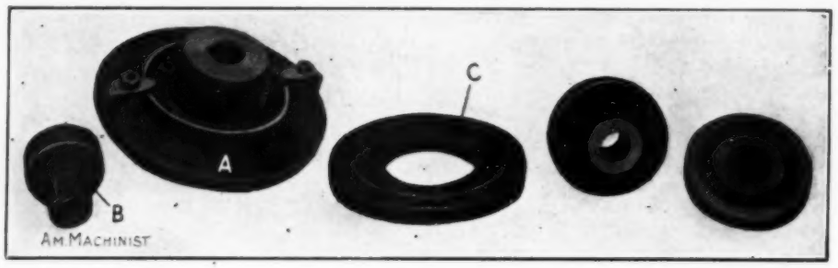


FIG. 7. JIGS FOR FLANGED COUPLINGS

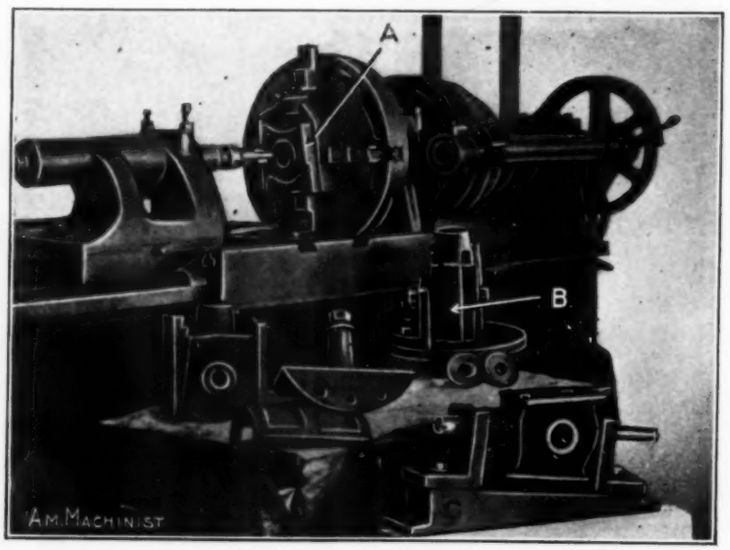


FIG. 8. CROSSHEAD MACHINING FIXTURES

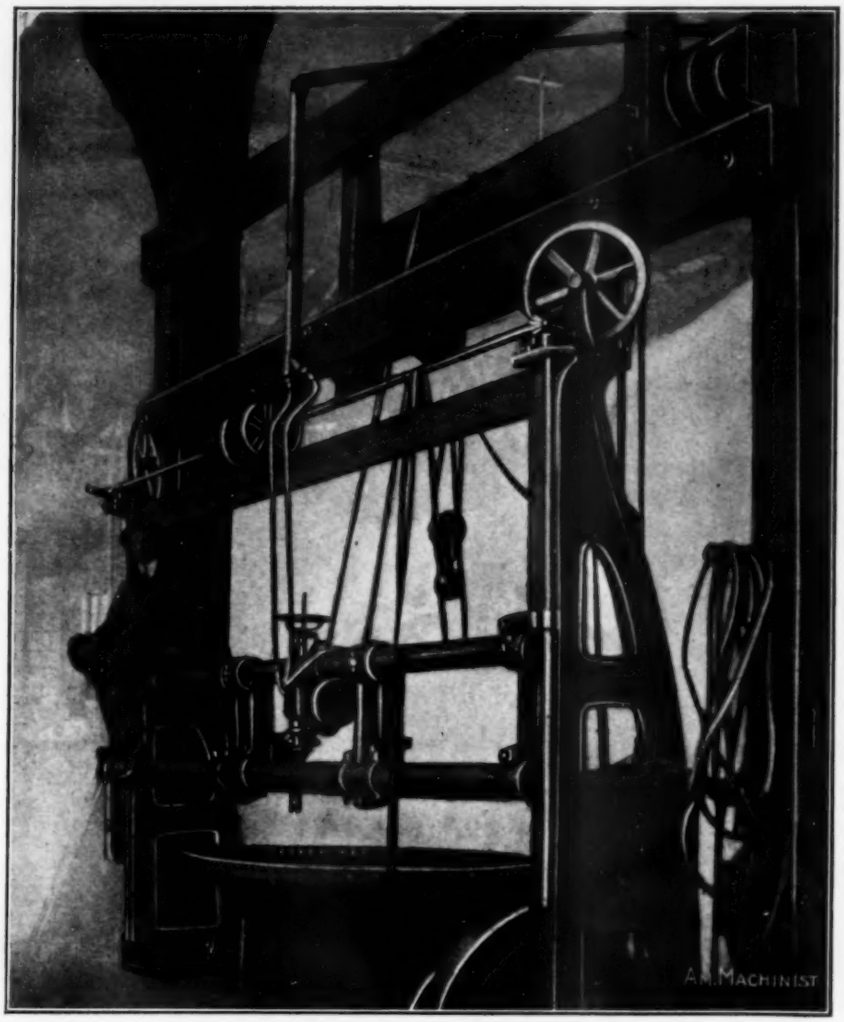


FIG. 9. AN OLD-TIME DRILLING MACHINE

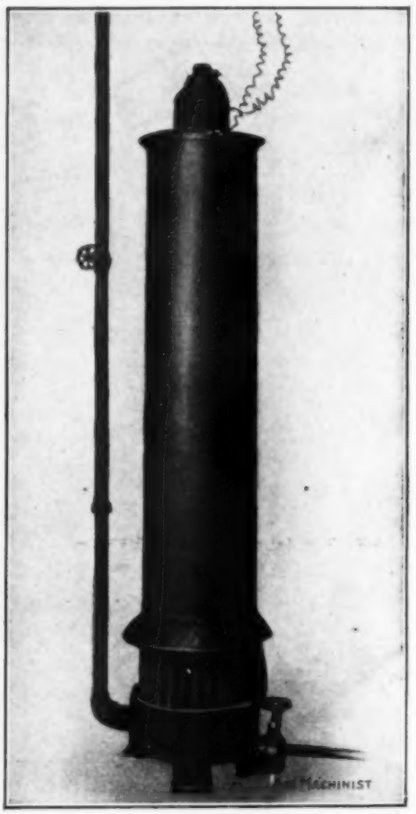


FIG. 10. A SHOP HEATER

eccentric groove *D* and a roller, in a way similar to the previous example. Held in this way the collars are easily faced off and quickly handled by the operator.

They are drilled on the jig *E* which is a plain angle piece with the stud set in it at *F*. This stud has a hole drilled in it larger than the holes required for the setscrews, so as to clear the drill and not cause them to break. The collars are spotted as shown at *G*, exactly where the setscrew goes. This centers the drill without using a hammer and center punch.

These spots are put on the pattern and are cast in. The collars do not turn on the stud and no locking device of any kind is required. They are then tapped in the drilling jig; and it is a peculiar fact that it requires more time to screw in the setscrews than it does to drill and tap them.

UNIVERSAL COUPLING JIGS

A set of drilling jigs for universal couplings is shown in Fig. 5. That shown at *A* is for drilling the blocks, the block being put in at *B* as shown, then the hinge clamp *C* is turned over and fastened; next the setscrew *D* is tightened and then the holes are drilled. Hardened steel bushings are placed on all four sides, and as these blocks have to be very accurate, the holes are drilled half from one side, then turned over and finished from the opposite side. The pin *E* is put through the first hole drilled to make sure that the block does not move.

The jig *F* is used to drill the forks, which are also drilled from both sides. At *G* is placed a steel pointer to show the center of the casting, the parting line being used as a guide. The mandrel *H*, over which the fork is slipped, lines the casting up so that the drilled holes are at right angles to the bore.

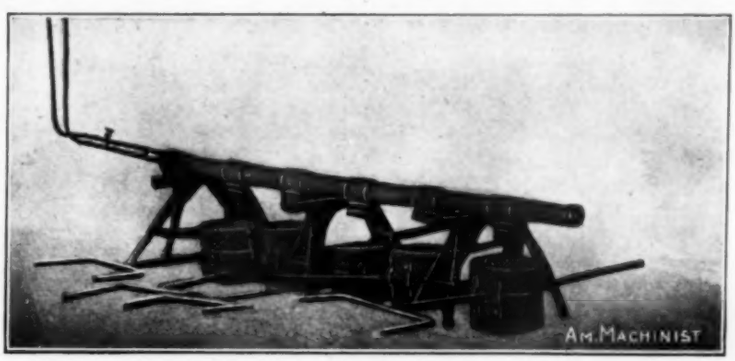


FIG. 11. LADLE-DRYING DEVICE

PATTERN FOR EASILY MACHINED COUPLING

A sectional view of a flanged-coupling pattern, the castings of which are machined with minimum labor, is shown in Fig. 6. These couplings are finished at *A*, *B*, *C* and the bore only, and they are much stronger than a coupling finished all over. At *A* and *B* the stock for finish is designed so as to leave the corners *D* and *E* round when the necessary stock is removed. The face *C* is relieved at the recesses *F* and *G*, which reduces the surface to be finished. The core prints *H* and *I* are screwed into the pattern and the recess *J* is for a rapping pin. The pattern is made of

metal and the castings have a uniform size and remarkable smoothness.

A set of jigs for machining the coupling castings is shown in Fig. 7. A boring jig or faceplate, which screws on the spindle of the lathe is shown at A. This jig has a recess to admit the flange of the coupling; the two clamps are the drivers and are quickly operated. After the coupling is bored, the hub and face are trued up, using the roller mandrel *B* which is the same kind as that used for the set collars. The holes are drilled by using the bushed jig *C*, which fits over the face of the coupling.

Crosshead Work

In machining crossheads for small engines, the crosshead is first chucked as shown at *A*, Fig. 8, and the boss faced off. A taper reamer is then run in the rough hole and it is finished at one cut. A collar on the reamer, which butts against the faced boss, insures all the holes being the same size.

The bosses on the inside of the crosshead are cast $\frac{1}{32}$ in. too wide apart, which saves turning them off. After reaming, the crosshead is placed on the faceplate *B*, which has a tapered pin to fit the reamed hole; the hole for the piston rod is bored with a double-end cutter in the tailstock, and then tapped the required size with a tap held in the same way. The surface for the slipper is planed while the crosshead is held in the jig, as shown at *C*. The slipper is planed and then fastened on the crosshead, which is then put back on the jig *B* and turned off.

An Old Drilling Machine

An old-time drilling machine used to drill rivet holes in boilers or very large boiler heads is shown in Fig. 9. It will drill to an 18-ft. center and take work 7 ft. high. It has two drilling spindles, but at the time the picture was taken one was removed for repairs. They are universal and can drill from any position.

This machine has been in use 30 years, but pulls high-speed drills as well as any modern machine. Boilers are rolled up to it and the rivet holes are drilled in very fast time. A drilling compound is forced through pipes to the drill, and the machine keeps up with the hydraulic riveting bull. However, as not all boilers are required to have drilled holes, most of them are punched on a standard punch.

A Shop Heater

A shop heater that has given unusual satisfaction is shown in Fig. 10. This heater has a hollow cast-iron base to which steam is admitted. Into this base a number of pipes are screwed, forming the heating unit. Over these pipes there is a thin sheet-iron casing, a few inches larger in diameter than the heating unit and running down almost to the base where it is flared out bell-shape.

Attached to the top of the casing is an electric motor which runs a fan at 1700 r.p.m. just above the end of heater pipes. This fan is so designed as to draw in the air from the top and blow it down through the casing and heater pipes. The air is thus heated to a high temperature and circulated all over the shop. The outlet pipes all lead to a receiver and the condensed steam is worked back to the boilers by the use of a Bundy steam trap.

Foundry Helps

The foundry is equipped with everything necessary to aid in getting work out promptly; a particularly handy part of the equipment is the multiple ladle-drying outfit, shown in Fig. 11. An oil burner is attached at one end and the oil and compressed air are conveyed to it from pipes connected by short pieces of hose.

After the ladles have been lined, they are placed under the openings as shown, and the burner lighted; the flame shoots out of the five openings and the lining of the ladles is quickly dried.

Handling Foundry Coke

A coke elevator and storage bin are shown in Fig. 12. A car of coke is run to the elevator and an inclined iron chute is placed on the car so that coke dropped on it will slide into the elevator buckets. Two laborers are employed to unload the car, and much time is saved over any ordinary method of handling. From the buckets the coke drops into a chute and slides into the center of the storage bin where it distributes itself evenly. The bin is watertight and saves the disintegration of the coke, which takes place when it is exposed to the weather.

The elevator is run by an electric motor which permits the stopping of all running parts when not in use. Pig iron is stored under the bin and is raised to the charging floor by an electric hoist.

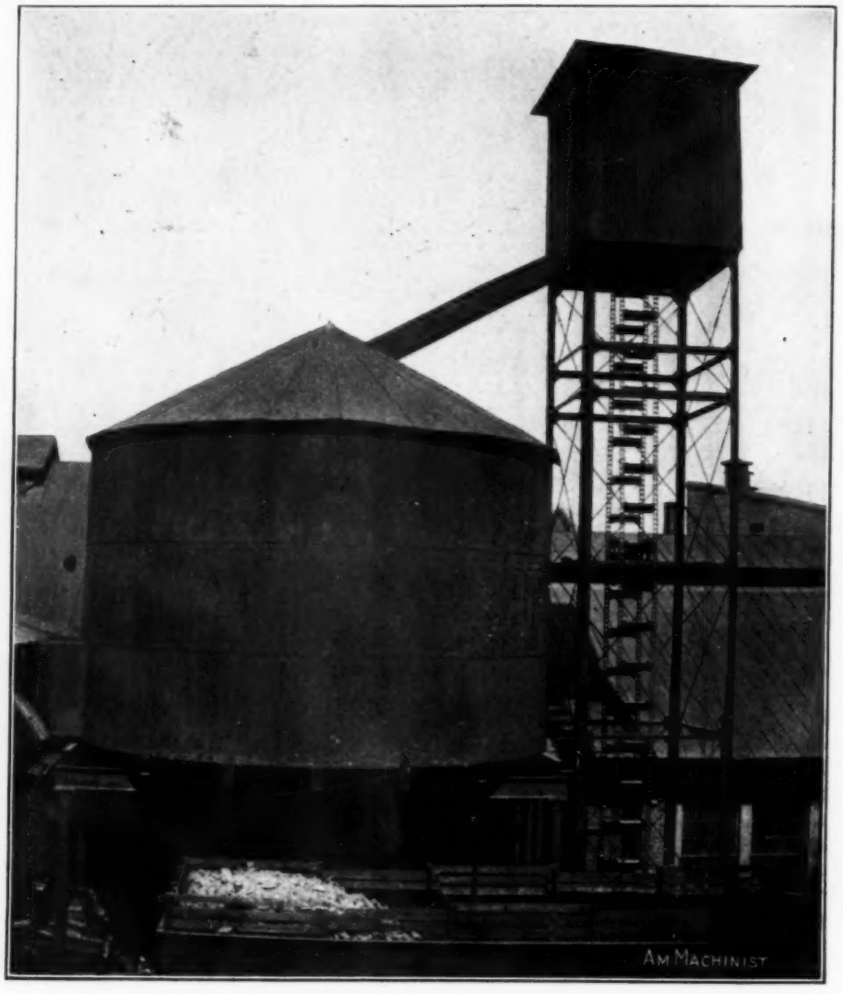


Fig. 12. Coke Elevator and Storage Bin

The strides that have been made in developing the quality of steel and other materials, must be credited largely to the automobile and the aëroplane. One of the late developments is wire for aëroplane stays or guys, which is made from 0.025 to 0.10189 in., with a tensile strength of 350,000 lb. per sq.in.

A Storage for a Million Patterns

By J. D. Mooney

A simple method of storing patterns in floor spaces, racks and bins. By means of the numbering system and a card index a few workmen can handle easily the patterns for a large foundry doing an exceedingly varied line of work.

The card system used in requisitioning for patterns and in recording the casts.

For such a large foundry plant as that operated by the General Electric Co., at Schenectady, N. Y., the question of storing and handling the patterns is a very important one.

Storage room for the 500,000 patterns already in use and a liberal allowance for future space requirements have been provided in a building recently completed. The new building, Fig. 1, of reinforced-concrete construction, is 563 ft. long by 73 ft. wide and five stories high. It covers 41,162 sq.ft. of ground, has a floor area of 197,375 sq.ft. and a contents of 14,211,000 cubic feet.

The building cost 90c. per sq.ft. of floor space, including the piling, but excluding the painting, steam pipes, elevators and sprinkler system.

The precautions taken against fire are quite complete. The building is of modern fireproof construction throughout. The windows are made of wire glass. A complete sprinkler system has been installed. Fusible links provide for the automatic closing of windows and fire doors in case of fire. Besides, there are hose stations spaced at short intervals on the various floors. The headquarters of the General Electric Co.'s volunteer fire department is a short distance from the pattern-storage building.

FIG. 1. THE PATTERN-STORAGE BUILDING

The office of the storage is practically a fireproof vault, with concrete floors, walls and ceiling, and wire-glass windows on all sides. The records there, showing the movements and location of the patterns, are thus well protected.

All parts of the storage are connected with all other parts of the foundry department by means of a shop telephone system, which provides for intercommunication through a standard 25-drop switchboard, located in the main office of the foundry. It is necessary also to have six standard Bell telephones for connecting the different parts of the department with the works system of telephones.

PATTERN STORAGE

The patterns are stored principally with regard to their size and convenience in placing them in the bays or racks. No attempt is made at systematic arrangement or grouping according to apparatus. The very large patterns are kept on the lower floors of the building. All of the patterns that are too large to be placed in racks are simply laid on the floor, Fig. 2. The smaller patterns are placed in racks, Fig. 3, and the very small ones in pigeon holes or drawers, Fig. 4.

The five floors are numbered from one to five, respectively The bays on each floor are numbered alphabetically. If the location of a pattern is given on the pattern-storage record files as 3-H, it means that the pattern specified is on the third floor and in bay H. The racks which occur on certain floors are numbered from one up; hence, if a location number is specified, for instance, as 2-11, it means that the patern is on the second floor in the eleventh rack from the end.

The location of the pattern in the rack is further specified, according to a subnumber, designating the compartment in the rack. These compartments are numbered from one up. Thus, if a pattern is in compartment 23 of the rack specified above, the complete designation of the location of the pattern in the rack is: 2-11-23. The location of the very small patterns in the pigeon holes is designated in the same way.

Workmen find the system very simple, and are able to find the patterns and put them away easily. These men show a rather remarkable capacity for remembering patterns and pattern numbers, which enables them to save a great deal of time in securing and placing patterns. There are 16 employed in the pattern-storage building; a foreman, three clerks, an elevator man, and 11 men handling patterns.

A list is made of every batch of patterns that leaves or comes back to the pattern-storage department. The workmen check the patterns against these lists, from which the "Pattern-Storage Record," Fig. 5, is posted.

The mechanical method of handling the patterns includes simply the trucks for conveying them, which run on standard narrow-gage tracks, and large elevators, located at either end of the building. Turntables, Fig. 2, located near the elevators, make possible the changes in the direction of the transporting truck.

THE ORDER SYSTEM

A form, "Iron Castings Order," Fig. 6, is made out by a typist in the department making requisitions on the foundry for castings. There are six copies of this form, an original and five carbons, all of a different color.

The original, marked "For Issuing Department's File," is filed in the office of the department ordering castings. The other five forms are sent to the iron-foundry office.

If the pattern for the castings specified is found by the foundry's record to be in the pattern-storage department, the copy marked "Molder's Copy," the copy

FIG. 3. RACKS FOR MEDIUM-SIZE PATTERNS

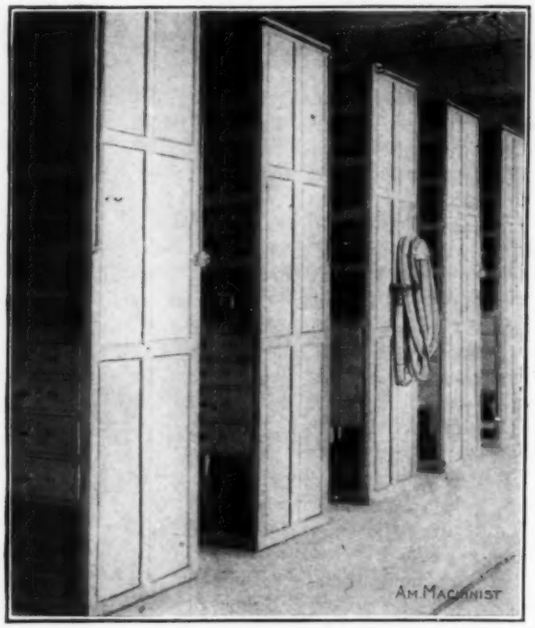


FIG. 4. BINS AND DRAWERS FOR SMALL PATTERNS

marked "Coremaker's Copy," and the copy marked "Pattern-Storage Copy" are all sent to the pattern-storage department.

The pattern is taken from the racks by the pattern-storage department and returned with the slip "Molder's Copy" to the foundry department; then this copy, containing the piece prices, is attached to the "Molder's Time Card," which will be explained later.

The "Coremaker's Copy" is sent with the necessary core boxes from the pattern storage to the core-making department.

The "Pattern-Storage Copy" is retained by the pattern-storage department to be used by this department in posting its records for showing the location of the patterns.

The copy marked "For Foundry Office File" is kept by the foundry office in a "Progress File," and the shipments or deliveries of the castings are recorded on this card, by means of which record the stage of completion of the order can be seen.

The copy marked "Foundry Production Clerk, 'Follow Up,'" is given to a clerk in the foundry office. There are several clerks, each one of whom is responsible for the castings of a certain number of

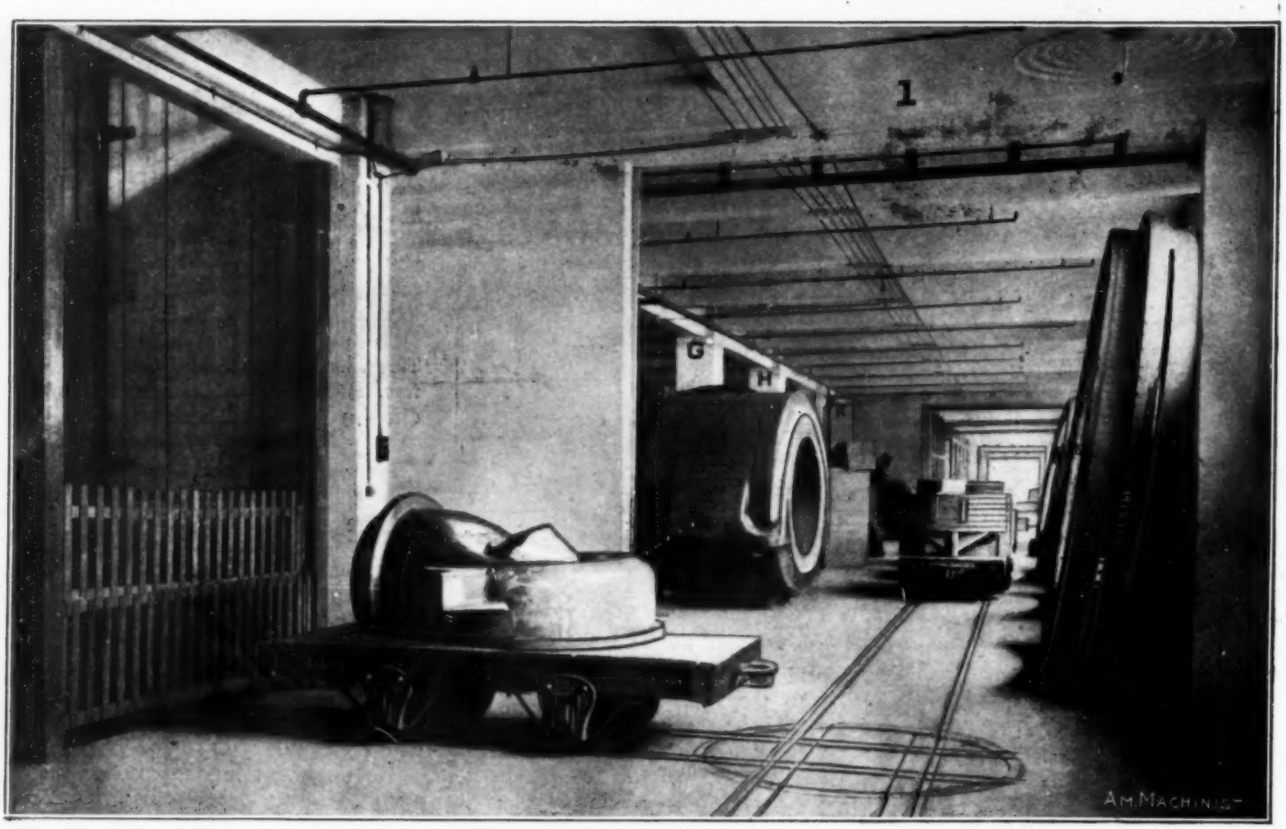
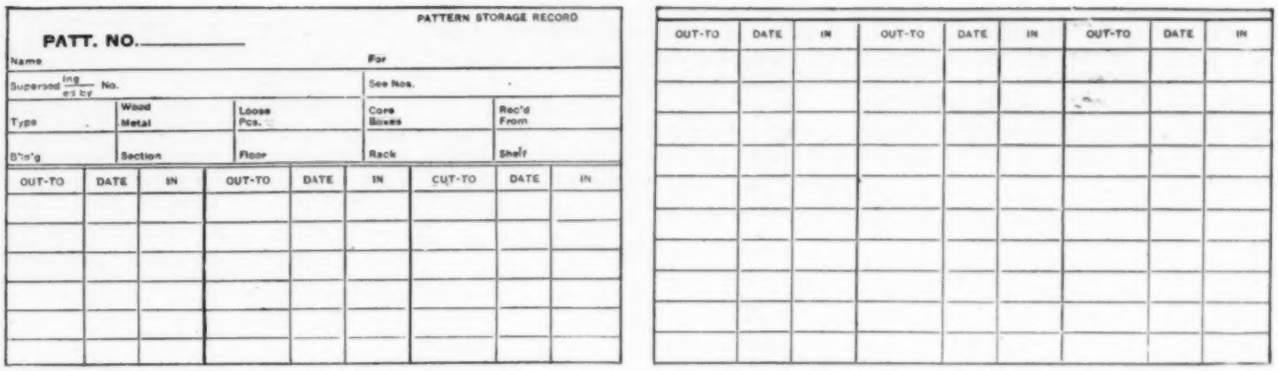


FIG. 2. THE FIRST FLOOR, FOR LARGE PATTERNS



PATTERN STORAGE RECORD

PATT. NO._____

Name For

Superseding or Superseded by No. See Nos.

Type | Wood | Metal | Loose Pcs. | Core Boxes | Rec'd From

Bld'g | Section | Floor | Rack | Shelf

OUT-TO	DATE	IN	OUT-TO	DATE	IN	OUT-TO	DATE	IN

OUT-TO	DATE	IN	OUT-TO	DATE	IN	OUT-TO	DATE	IN

FIG. 5. FRONT AND REVERSE SIDES OF "PATTERN STORAGE RECORD" CARD

departments of the works, and watches the work for them. He keeps the foundry foreman informed as to delivery dates and as to which castings are in a hurry.

The clerk keeps his records on these cards up to date by watching the castings in their progress through the foundry, where he spends much of his time, and by checking his cards occasionally with the foundry "Progress System."

A good many of the iron-castings orders are made up by typists in the foundry office from requisitions sent in to this office in long hand by some of the smaller departments of the works, as the quantities of their work would not justify employing typists for this purpose.

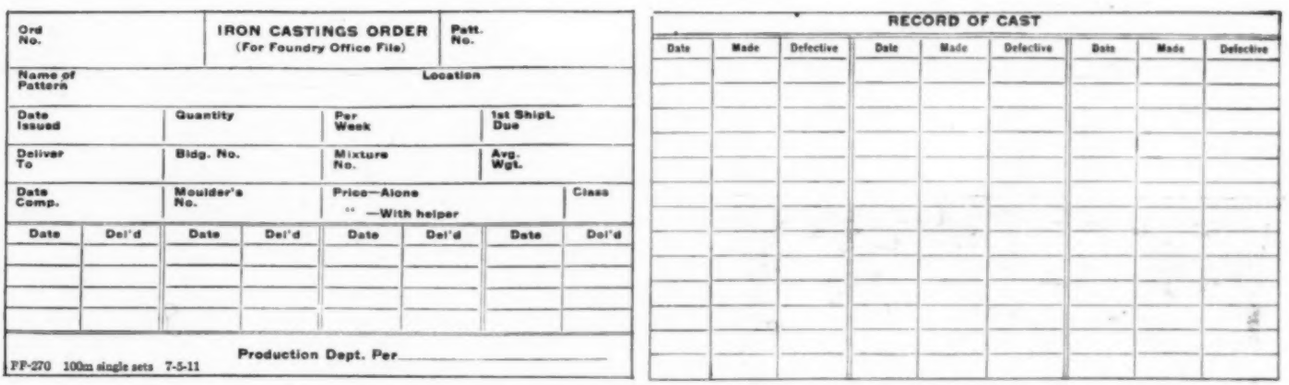
MOLDER'S TIME CARDS

The "Molder's Time Card," Fig. 7, is made in triplicate by a typist in the foundry office from the "Iron-Castings Order." The typist fills in the pattern number and letter, number of castings wanted, the description, building number, department, the account and class, and the date.

The triplicate form is sent to the foundry foreman, who handles the allotment of the work to the various molders. After the work has been completed, if the order is small, or at the end of the day, if he has only partly completed the order, the molder fills out the card and returns it to the foundry office. He puts his name on the card, his check number, how many men he had helping him, the number of castings in each mold, and the number of molds completed. He returns two copies of the card to the foundry office and retains the triplicate himself as a means of checking his wages.

If he thinks, when his weekly wages are handed to him, that there is a shortage, he takes the triplicates covering the wages received to the foundry office, to determine any possible discrepancy. The foundry office sends the duplicate of this form to the weighmaster for his report of the weight of the castings and any defectives that must be deducted from the number of castings reported by the molder.

If the original returned to the office shows that a molder has completed only



Ord No. | IRON CASTINGS ORDER (For Foundry Office File) | Patt. No.

Name of Pattern Location

Date Issued | Quantity | Per Week | 1st Shipt. Due

Deliver To | Bldg. No. | Mixture No. | Avg. Wgt.

Date Comp. | Moulder's No. | Price—Alone / —With helper | Class

Date	Del'd	Date	Del'd	Date	Del'd	Date	Del'd

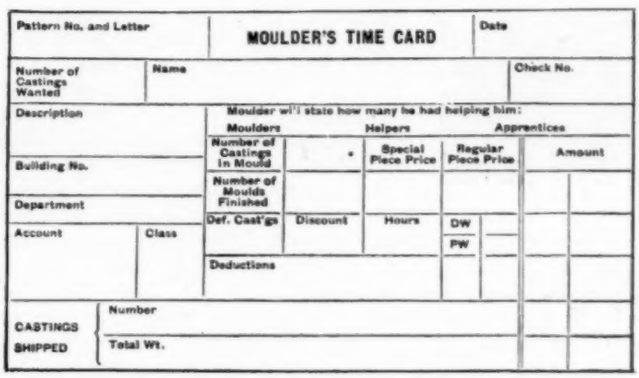
Production Dept. Per_____

FF-270 100m single sets 7-5-11

RECORD OF CAST

Date	Made	Defective	Date	Made	Defective	Date	Made	Defective

FIG. 6. FRONT AND REVERSE SIDES OF "IRON CASTINGS ORDER" CARD



Pattern No. and Letter | MOULDER'S TIME CARD | Date

Number of Castings Wanted | Name | Check No.

Description | Moulder will state how many he had helping him: Moulders / Helpers / Apprentices

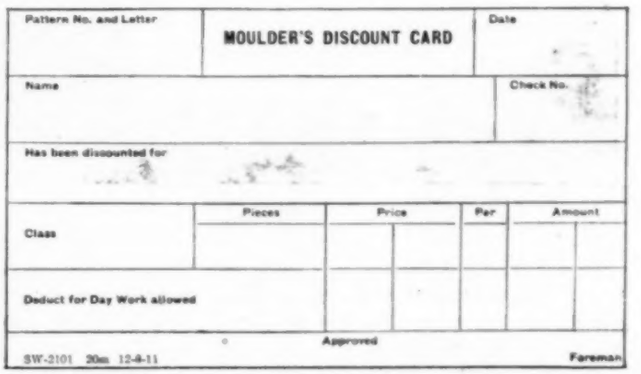
Building No. | Number of Castings in Mould | Special Piece Price | Regular Piece Price | Amount

Department | Number of Moulds Finished

Account | Class | Def. Cast'gs | Discount | Hours | DW / PW | Deductions

CASTINGS SHIPPED: Number / Total Wt.

FIG. 7. MOLDER'S TIME CARD



Pattern No. and Letter | MOULDER'S DISCOUNT CARD | Date

Name | Check No.

Has been discounted for

Class | Pieces | Price | Per | Amount

Deduct for Day Work allowed

Approved Foreman

SW-2101 20m 12-9-11

FIG. 8. MOLDER'S DISCOUNT CARD

part of the order, the typist makes out a new "Molders Time Card" in triplicate for the balance and sends it out into the foundry to serve as a new order for the molder. This method of making out new cards takes from the molder's shoulders the responsibility of record keeping.

This card shows the rates paid for the various operations connected with making the castings for the pattern number and apparatus specified.

The foundry pattern office keeps an "Active Pattern File," Fig. 10. This record is posted from the "Iron Castings Order" and the "Molder's Time Card."

F. F. 284. 100M-3-11-11 IRON FOUNDRY PIECE PRICE RECORD

Pattern No. Apparatus

OPERATION	OPERATION NO.	PER	PRICES							
			DATE	PRICE	DATE	PRICE	DATE	PRICE	DATE	PRICE
Moulding –Floor	1									
" –Bench	2									
" –Machine	3									
Core Making (a)	4a									
" " (b)	4b									
" " (c)	4c									
" " (d)	4d									
Polishing	5									
Cleaning out cores	6									
Moulding for pattern	7									

FIG. 9. IRON FOUNDRY PIECE-PRICE RECORD

PATTERN NO. FF-274 (revised) 20m 7-21-11

ACTIVE PATTERN FILE--FOUNDRY OFFICE

LETTER	DATE FROM PAT. STORAGE	TO WHOM GIVEN	DATE TO MOULDER	RET'D TO PATTERN STORAGE	DATE FROM PAT. STORAGE	TO WHOM GIVEN	DATE TO MOULDER	RET'D TO PATTERN STORAGE	PRICE	DATE

FIG. 10. "ACTIVE PATTERN FILE" CARD

The "Progress File" is kept up to date from the original molder's time card, and from the copy sent back by the weighmaster to show defectives. The number of deductions is shown on the duplicate and posted from this to the "Progress Card." The original molder's cards are finally sent to the paymaster's department to serve as vouchers for the molder's wages. The duplicate also shows the piece price. The duplicates are turned over to the cost department to serve in the computation of costs and piece prices.

A "MOLDER'S DISCOUNT CARD"

The card, Fig. 8, is made out for all defectives discovered after the castings have passed the weighmaster. This card is made in triplicate; one copy goes to the paymaster, one to the molder, and one to the cost department.

An "Iron Foundry Piece-Price Record," Fig. 9, is kept of the piece prices paid. It shows the location of the pattern. If a pattern is in the foundry, it shows which molder is using it, and as his name remains on the card after the pattern has been returned to the pattern storage, it is possible, if a casting is returned to the foundry because of a defect, several months after it was made, to determine which molder made the casting.

Percentage Weighing Machine

BY FRANK C. PERKINS.

The illustrations show an English percentage weighing machine of the Avery type, developed at Birmingham, by the Soho Foundry, for accurately proportioning materials to be used in foundry or other mixtures. It is of the platform type, and has a maximum capacity of

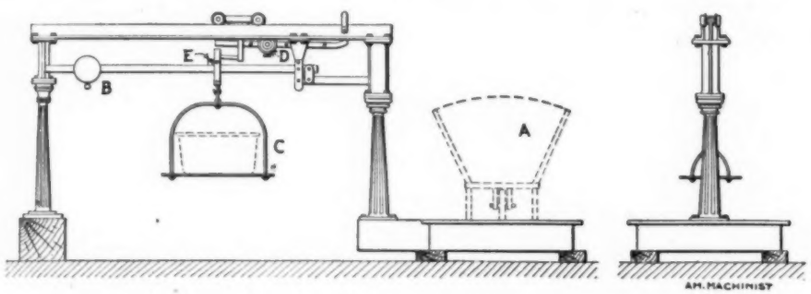


FIG. 2. SECTION OF PERCENTAGE WEIGHING MACHINE

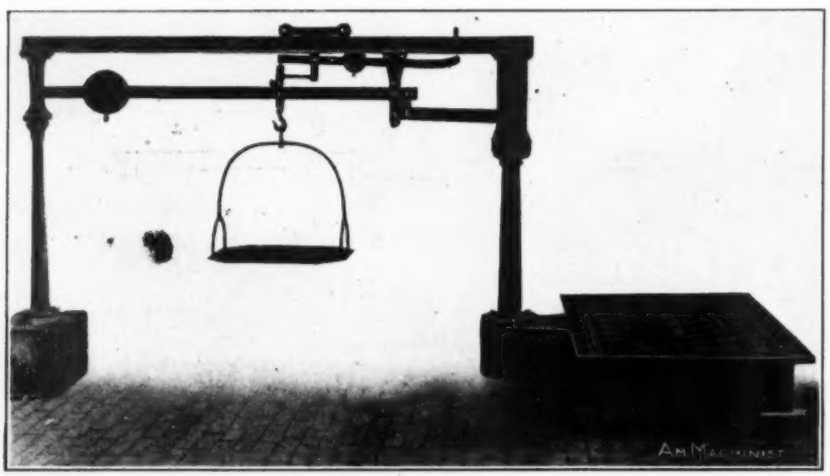


FIG. 1. PERCENTAGE WEIGHING MACHINE

336 lb., the percentage of the component materials being varied according to requirements.

The hopper or other receptacle used to contain one component of the mixture, is placed on the platform and the tare taken by means of the movable poise *A* on the large steelyard. The receptacle for the second component is placed on the swinging pan *B* and poised by means of the weight *C* on the smaller steelyard. The runner *P*, carrying the bucket *E*, is then adjusted along the frame until its position coincides with the percentage which it is desired the material contained in *C* shall bear to that on the platform, the percentages being marked off on the large steelyard.

Material to any amount is then placed in the platform receptacle and the other filled with the other component until the two balance, when they bear the exact proportions required to each other and may be mixed together. The use of this machine avoids the errors in calculating and the need of making up the larger quantity to any definite weight.

Laying-out Tool for Diesinking Jobs

By Geo. W. Smith

A handy tool designed to facilitate the laying out of dies from a model which is difficult to measure on account of irregular outline and varying sections.

The die sinker is often called upon to work out a pair of dies from a model which is difficult to measure because of its irregular outline and varying sections, that is to say, it has no plane surfaces to measure from. It was to facilitate the laying out of this class of die that the little tool shown in Fig. 1 was designed.

Construction of Tool

It consists of a stock made in two pieces and held together with two screws. Between the two parts is formed a pocket partly in each piece of the stock, this is to hold the spring which presses the blade onto the die or template when in use, and also keeps the blade assembled in the stock when not in use.

The one side of the stock is furnished with a semicircular groove in the slot in which the blade slides. This allows a piece of wire of suitable section to be soldered to the blade, thus keeping it in correct alignment with the base 90 deg., and also prevents the spring from pushing the blade out of the slot. The lower end of the blade is sharpened by grinding off at an angle so that the sharp edge is in alignment with the straight edge of the blade. By sliding downward it may be taken out for sharpening as often as required and may be inserted again from the top.

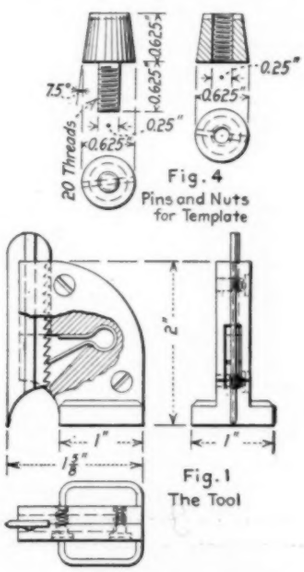


Fig. 4 Pins and Nuts for Template

Fig. 1 The Tool

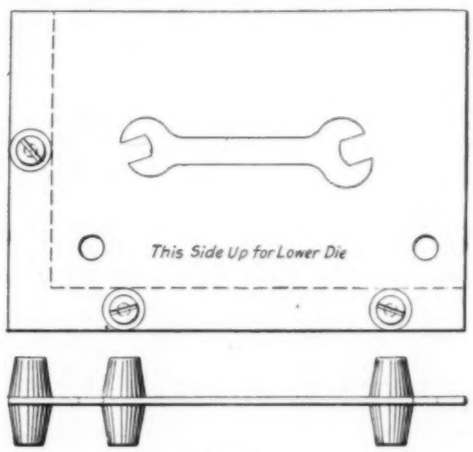


Fig. 3 Showing Template Margin

A Tool for Laying Out Troublesome Diesinking Jobs

From the description of the tool it will be seen that if the model is laid on the die or template and firmly held there it will only be necessary to take the tool, Fig. 1, press its base on the template, with the edge of the blade in contact with the model, to transfer the location of the point of contact to the template. Drawing the scriber round the model in this way will transfer an accurate outline of its widest section to the template with no more trouble than ruling a line with scale and scriber.

Transferring the Model Outline

The operation is shown in plan and elevation in Fig. 2. This elevation also serves to show a very handy way of holding the model and template quite rigidly together while the outline is being marked off. The template is placed on the drill table with the model in the required position, the drill spindle is then lowered until the chuck jaws nearly touch the model, the chuck is then closed, which brings the jaws downward and will hold the model quite securely while the marking off is done. If the chuck is not of this type then a little jackscrew will do as well.

In this way it is possible to mark off the whole outline at one setting, which cannot be done when clamps or clips are used. Should the model be thicker in one place than another, a little jackscrew must be used underneath the thinner end, or a touch of soft solder may be used. This is very useful when the model has no flat faces; it is easily applied and cleaned off after use.

Dies Should Be Standardized

With reference to the dies themselves, it will be found a great advantage to standardize these, not merely as to their size, but also the angle of side. When this is done it will be found an inexpensive job to machine them all over. This is thought by some die makers and drop-forge men to be unnecessary. If, however, it is done, the die maker will soon appreciate this, as he will be assisted considerably in his work by the knowledge thus obtained of the distortion in the various kinds of steel used.

If the sides of a die are left rough from the forging, it may be seen after hardening that distortion has taken place. If however, the sides were machined, even roughly, then the distortion may be measured.

As far as possible the dies should be standardized as to length, width, height, and angles of sides. If this is done a few jigs will insure, even with an unskilled worker on the job, that the dies are parallel, top and bottom, the ends square with the sides, and the sides will have the same angle with the bottom.

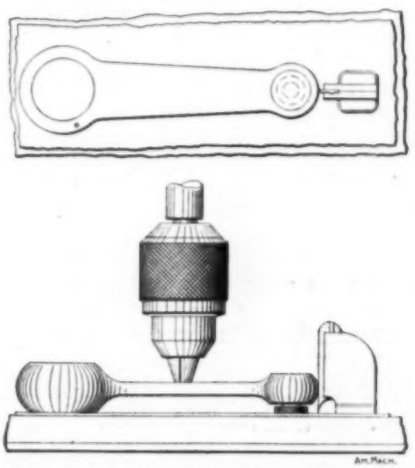


Fig. 2. Transferring Model Outline

Template Measurements

Coming now to the templates themselves; an excellent plan is to make them about 0.625 longer and the same amount wider than the face of the die to be used. This extra width and length are used as a margin and marked off and drilled, as shown in Fig. 3, to take the three pins and nuts shown in Fig. 4. These pins and nuts are made to the measurements given; the diameter and angle of both nuts and pin heads must be the same, provided the angle of both top and bottom dies is the same.

The template is also drilled with a 0.25 hole in one corner if the dies are for hot work. The template with the screws and nuts assembled is then placed on the die for marking off; the hole is also transferred to the die, the drill being fed in to the depth of the cutting edges only. The screw heads or nuts are kept in contact with one side and one end of the die, the template is reversed for marking off the other die and the hole also transferred.

From this it will be seen that in setting the dies in the drop, the operator, to be quite certain that the impression will match correctly, has only to see that the ends and sides of the two dies match each other, and that the holes in the corners also match.

For thin sheet metal that has to be struck up in the drop, it is a good plan to put two drill holes in the template and when marked off onto the die, to drill them a little deeper, say about 0.150 in. Then when the surplus has to be clipped off and a margin left, the metal receives the impression of the two holes and these furnish a ready means of locating the work for the clipping operation, the clipping die having the two holes transferred just the same as the raising die. These methods have, and will prove, themselves time savers.

The "profile scriber" should be a useful tool for laying off the stripping plates for the molding machine.

Press Tools for a Ribbon Follower

By C. A. Diller

The piece shown in Fig. 1 is a complicated part used in the ribbon movement of a typewriter, and as it is a rather difficult part to handle, the press tools used in producing it will be of interest to the readers of the American Machinist.

These parts are blanked out two at a time from strips of medium-hard cold-rolled steel, 0.05 in. thick and 2¾ in. wide, the blanks looking as at *A*; then the holes *B* and *C* are pierced and the part cut out at *D*, using the die shown in Fig. 2, in which the piece is held by the straight part and inserted between the stripper plate and die block against a guide or nest, which is shaped to fit the blank. Hardened bushings set into a machine-steel block are used instead of solid tool steel for the die.

The bending operations, three in number, are performed with punches and dies illustrated herewith, and as the pieces are made right and left, the bending tools are made to form either.

Fig. 3 is for bending the part *E* at right angles to the blank, and also giving it the curve shown at *F*, the blank being laid on the spring pad *G*, and between the guide plates *H* and *I*. The punch *J* forces the spring pad down and the piece is shaped by being bent around the die *K*.

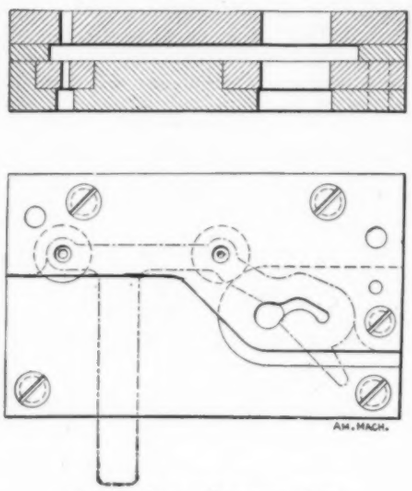


Fig. 2. The Piercing Die

The bends *L* and *M* are made in the die shown in Fig. 4, being located between the pins *N* and the guide plates on the die, which is provided with a spring-pressure device. There are four parts to the punch, the middle one or spring pad *P* holds the piece on the die, while the punch *R* makes the bend *M* and forces the die down, when the punch *S* makes the bend on the die *T*.

In the last bending operation, consisting of the three bends *U*, *V* and *W*, the punch and die, Fig. 5, are used. The piece is laid on the spring and die *X* and die *Y*, the latter having the form of the bend *M*, which was made in the previous die, in order to locate it. The end of *L* rests on a part at the back of the die. The punch first holds the part on the spring pad, and as it is forced down, bends *V* and *W* are made between the sides of the punch and dies, and the curved arm *L* is also bent against the die at *Z*, the punch being shaped out in the back for clearance.

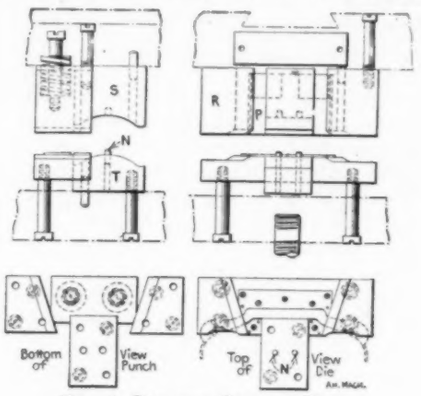


Fig. 4. Die for Second Bend

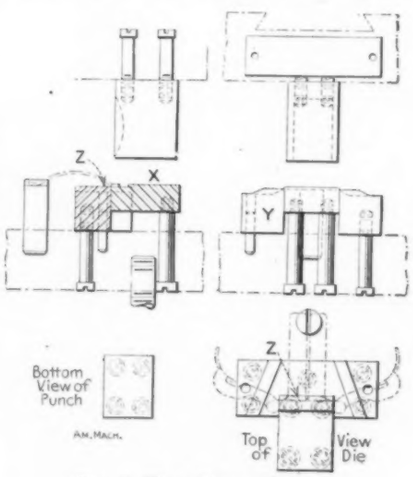
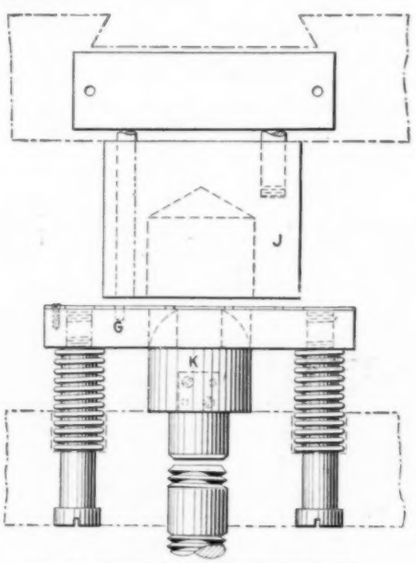


Fig. 5. The Final Bends



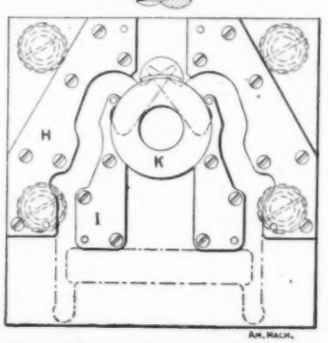


Fig. 3. The First Bending Die

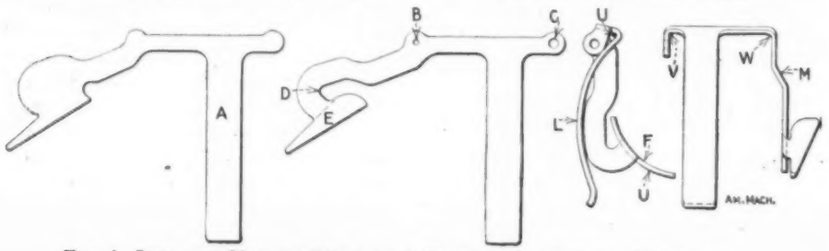


Fig. 1. Steps in Making Part of a Typewriter Ribbon Movement

Reminiscences of Oscar J. Beale

By Luther D. Burlingame *

Personality and achievements of a man who was exceptionally well known in the machine-building world.

The record of his rise through his own efforts from the life of a boy on a New England farm to the position of an authority on the complex subject of gearing, should be an inspiration to all. His work in developing standards of length was pioneer work of the highest quality.

Mr. Beale held a peculiarly close relationship to the readers of the AMERICAN MACHINIST, as he was a frequent contributor to these columns, both over his own name and the well known pen name "Jarno."

*Chief draftsman, Brown & Sharpe Manufacturing Co.

When a man's life work has been such as to leave a name honored for what has been accomplished, it is interesting to examine those traits and habits which have gone to make up the personality of such a man, and which have had to do with his success.

As one intimately associated with Oscar J. Beale during more than a quarter of a century of his life work, and one who had a high appreciation of the qualities which, applied to mechanical matters, made his name well known throughout the mechanical world, it is a satisfaction to me to place on record some reminiscences of such a life, reminiscences which I believe will be of interest to mechanics who have made their own way and to young men just starting out in mechanical work, as well as to those who have known Mr. Beale personally.

My first acquaintance with Mr. Beale was in 1884, when I entered the employ of the Brown & Sharpe Manufacturing Co. as an apprentice in the drafting department. Mr. Beale was then foreman of the gear department, which was located adjacent to the drafting room, so that I saw much of him from the beginning. My first impressions of him were of a man of distinction, of portly proportions, florid complexion and with iron-gray hair, which afterward became almost snowy white. The fact that he was particular as to his personal appearance almost to the point of fastidiousness emphasized this early impression. Fig. 1 is from a photograph taken at this time.

As foreman of the gear department, Mr. Beale not only performed the usual duties of such a position, but he made a study of the whole science of gearing, back to its fundamental principles, this largely as a matter of scientific interest and outside of business hours. At the time of our first acquaintance, he had already established a name as an expert on all questions of gearing, and when any of us in the drafting department had any perplexing questions, not only in matters of gearing, but in any cases where mathematical reasoning was involved, we found in Mr. Beale a ready helper.

While his early schooling had been limited and he had been dependent on picking up his education a little here and a little there, like many another self-made man, he did it to such good purpose that, with a term at the Towle Academy, studying geometry and algebra, followed by private lessons in the latter and some lessons in mechanical drawing under a tutor, he became so well grounded in the fundamental principles of these subjects that almost any problem would yield to his analysis.

His perception was cultivated by years of experience as inspector and later as chief inspector for Brown & Sharpe. His accurate memory of facts also stood him in good stead and a favorite expression of his was that he had learned a thing

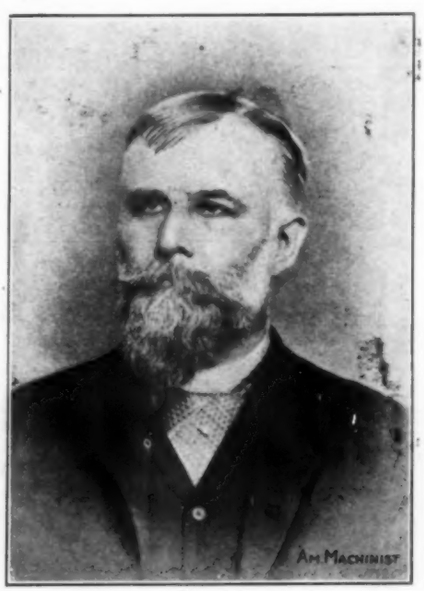


FIG. 1. OSCAR J. BEALE, WHEN FOREMAN OF THE BROWN & SHARPE GEAR DEPARTMENT

so thoroughly that "he knew it as two o'clock in the morning." When traveling he often took a book on geometry with him to read for amusement, just as one would ordinarily take a novel.

Mr. Beale was foreman of the gear department at a time when the epicycloidal system of gear teeth still held its own to some extent, and had its advocates among machine-tool builders, and at a time when the system of planing bevel gears by the Bilgram and other processes was just being introduced, a Bilgram gear planer being then in use in our gear department.

Mr. Beale's studies in gearing led him to the conclusion that a machine could be devised to generate accurately the forms of epicycloidal teeth, and he worked out his own plans, made his own patterns and with the aid of a foot-power lathe actually built such a machine in his attic at home—some parts, however, being made at the Brown & Sharpe works. This machine is shown in Fig. 2.

HIS EARLY SHOP TRAINING

That he could successfully perform this work under such difficulties well illustrates the resources of the old-time mechanic when handicapped by inadequate equipment. That Mr. Beale was such an old-time mechanic and that he acquired experience under such conditions of inadequate equipment may be gathered from some of his early experiences. At the age of 13 he began work in a machine shop in Winthrop, Maine, following an unsuccessful effort to make a farmer of him. This shop manufactured agricultural implements, such as corn shellers, etc. Mr. Beale said that in this shop there were five engine turning lathes, three of them being chain feed, and that of the three hand lathes two of them had wooden beds.

Almost from the beginning young Beale showed a bent toward mechanical work especially in the direction of saving hand labor (his own). He tells us that at one time when he had a number of thin iron hoops to bend around and rivet, he devised the plan of putting one end of the straight blank between a belt and its pulley and then rotating the pulley, thus forming the hoop in about two seconds, a great saving in time and labor over former methods.

Following his experience in Winthrop, Mr. Beale worked in Lewiston and later in Portland, Maine. The great Portland fire of 1866 burned out both the machine shop where he was working and his boarding house. Within a few days, however, he was again at work, this time at the Portsmouth Navy Yard where he remained until 1869, when he went to Providence and entered the employ of Brown & Sharpe as a bench hand.

It was the fact that he showed some knowledge of toothed gearing that led to his employment after first having been told that no more help was needed. He pursued the study of algebra and geometry at first with the hope of going to

college, an ambition which he reluctantly gave up under the influence, perhaps, of one of his teachers, himself a college graduate. This teacher said to Mr. Beale: "You have a good trade. There is no other substance that is wrought so much as iron. You never need lack for employment. Your chances in life are better than mine today."

This expression of the value of a trade was a new thought to young Beale and it led him to an appreciation of the fact that a machinist can have ample scope to exercise his mental powers in the study of the problems and principles of his trade.

While in Portland Mr. Beale worked on stationary and marine engines and this led him to take an interest in steam engineering. He tells us, however, that a half hour spent on a freight engine, shifting cars, permanently closed the locomotive avenue of his steam engineering ambition, and that the sight about two years afterward, of an engineer on duty in a government steamer's fireroom completely silenced any remaining ambition to run a steam engine.

Early Work in Gearing

The odontograph machine which Mr. Beale so laboriously built in his attic was later purchased by Brown & Sharpe and was presented a few years ago to Columbia University, where it is now preserved.

It led to commissioning Mr. Beale to design an "odontom engine" of much larger scope. This engine, in addition to means for describing the curves, has an arrangement for milling the outlines of epicycloidal gear teeth; that is it actually cuts out original teeth in thin gears. This machine was built in the eighties and is now in the possession of Brown & Sharpe and has been used to produce the forms for the epicycloidal cutters since made by them. This was a turning point in Mr. Beale's career, for the work as a machine designer was along lines most congenial to him and to which he was well adapted both by training and natural ability.

About the time that the first of these odontom engines was built and when Mr. Beale's thoughts were turned in the direction of gearing problems he found that there was a lack of definite information on the subject of gearing and that what there was was not in shape to be understood or used by the man in the shop who had work to do. This led him to prepare some lessons in gearing, together with tables of tooth parts, etc., put in such form as to be plain for the workman's use. These lessons were in the form of blueprint sheets bound into a book which was sold for four dollars a copy. The blueprints for these books were made at home by members of Mr. Beale's family.

Preparation for Technical Writing

The little book of blueprints which constituted the set of twelve lessons in gearing, was named, "Beale's Blue Book." (See Fig. 3) and had quite an extended sale. It proved so practical and popular that Brown & Sharpe made arrangements with Mr. Beale to take up its publication by greatly enlarging it and putting it into printed form. This became the "Treatise on Gearing" first published in 1886 and now, in its revised form, so well known throughout the mechanical world.

The work in connection with preparing this book for publication was a new field for Mr. Beale and as had been the case with other of his undertakings he made a business of equipping himself for it and for similar work. He secured and made a study of books in rhetoric, punctuation, proof-reading, and whatever would aid in writing for publication. He was not naturally a ready writer, but by painstaking labor acquired a style having originality and free from the ordinary errors of many writers.

He was a careful student of writers of English having a reputation for their style and use of language, and profited by such reading in his own writing. His ability to classify his acquired knowledge and make it practically available in his everyday work was soon shown

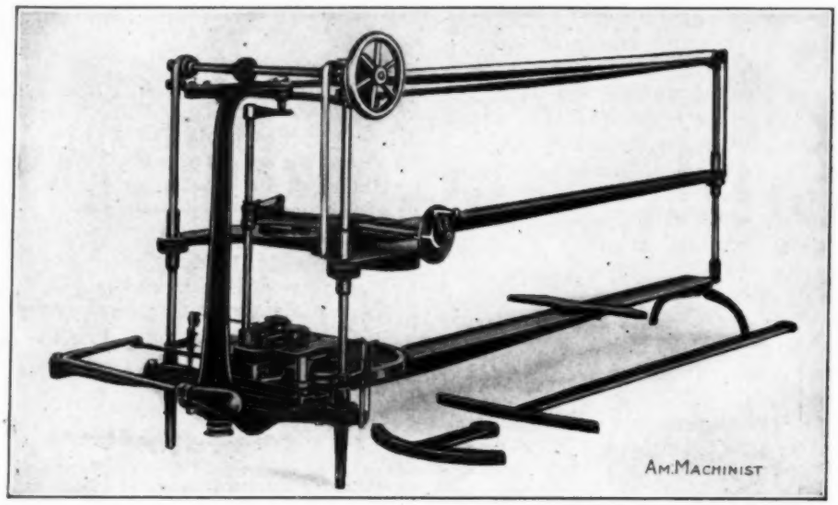


Fig. 2. Machine Built by Mr. Beale to Generate the Curves of Epicycloidal Teeth

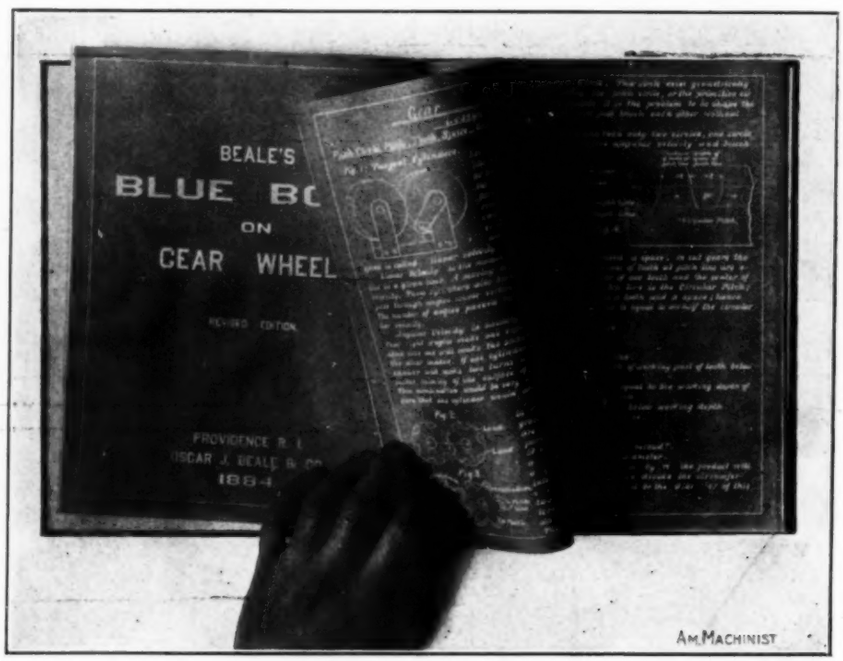


Fig. 3. Beale's Blue Book

in this matter of the use of language, both in his own work and as a critic of others. In fact a favorite amusement of his was to select some writing which purpoted to teach the correct use of language and pick it to pieces. showing how it failed to follow its own rules.

During the time that the book on gearing was in preparation, Mr. Beale commenced to write for the AMERICAN MACHINIST, some articles on gearing appearing in 1885. The next year he adopted the pen name "Jarno," which soon became well known. This pen name was taken from a character in Goethe's "Wilhelm Meister's Apprenticeship," who was a looker-on, or observer, with a knowledge of what was going on and possessing well balanced opinions.

Many important articles from Mr. Beale's pen can be found in the mechanical papers following this date, especially in the AMERICAN MACHINIST, to which his most important contributions were made, such contributions continuing down to the time of his death. Another of his literary efforts which has become well known is his "Handbook for Apprenticed Machinists." This brought together material from many sources and in preparing it he showed a trait prominent in all his work—that of consulting others and getting help from those having the information at first hand. This was also especially noticeable in his shop and designing work.

A FEW INDIVIDUALITIES

Many individualities distinguished Mr. Beale. These are illustrated by his practice of using either his right or left hand for writing or sketching. He had a way of notching his drawing pencils so that he could identify them. This he did holding his knife in his left hand in such a way that it would be difficult for others to duplicate his marks. His sketching was of a character which no matter how rough, clearly conveyed the idea he had in mind. He also trained his eye to judge distances and prided himself on being able to do so accurately.

I remember once when he was lecturing before the Providence Association of Mechanical Engineers he had occasion to use the blackboard and remarking that we might call a certain space 6 in., which he marked off with the crayon, he drew a scale from his pocket and showed with great satisfaction that it was 6 in. as nearly as the eye could detect.

Mr. Beale's position as well as his scientific interests often brought him in contact with noted men in many walks of life. Once in conversation with Prof. Reuleaux the subject of the principles of the Bilgram gear-cutting machine was taken up and the professor questioned whether a straight line such as the edge of a steel band or tape, could be wound around a cone. Mr. Beale, to illustrate that it could, took a square of memorandum paper and wound it into a cone, then unwinding it showed that one edge was a straight line. Prof. Reuleaux at once saw the point.

This ability to mentally see the reasoning, or, as Mr. Beale called it, the "geometry" of the problem in hand, when coupled with long experience as an expert machinist and mechanician, acted as a balance to insure a practical application of the principle to be employed. Many of his inventions were in the nature of working out a geometrical principle in a mechanical structure.

An illustration of this is shown in the spiral gear, Fig. 4, where a series of strings stretched on a frame shows the path of the cutter used to cut the teeth.

This ability to apply geometry was especially apparent in Mr. Beale's work on gear-cutting machinery. When the great boom in bicycle building occurred, including the demand for accurate bevel gears for quiet running, Mr. Beale invented a generator in the form of a crown gear, or as he expressed it "a rack bent around into a ring," which acted on the teeth of the gear, which had previously been roughed out, to generate a theoretically correct tooth by providing an abrading surface on the generator to be followed by a burnishing generator to complete the process. This method, while extensively employed, has now been largely superseded, although it still has its use for certain classes of work. A rack-cutting machine having many novel features of design adds another to the long list of machines invented by Mr. Beale.

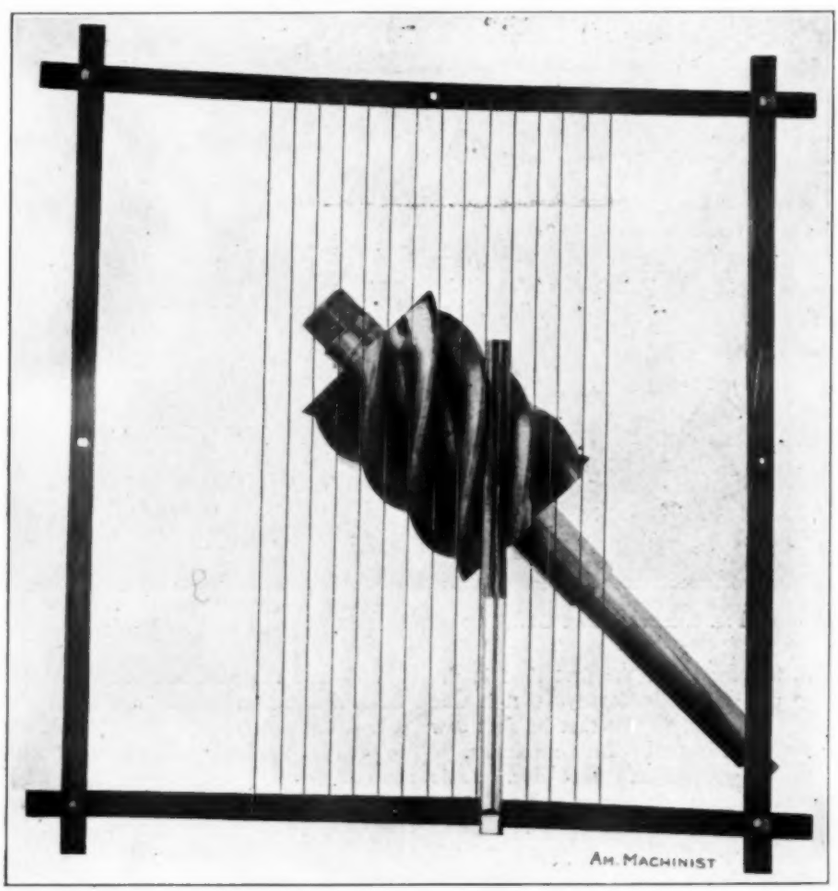


FIG. 4. DEMONSTRATION OF PATH OF CUTTER IN CUTTING A SPIRAL GEAR

HISTORY OF ONE OF HIS LATER INVENTIONS

A still later invention of his in the line of gear-cutting machinery has an interesting history This is the bevel-gear gengenerating machine shown in Fig. 5. This was fully illustrated and described in the AMERICAN MACHINIST of Jan. 29, 1903. At the time of this invention processes for cutting bevel gears which would produce theoretically correct teeth were gaining ground, even though they were necessarily slower than those employng a rotary cutter. This invention of Mr. Beale's consisted in retaining the rotary cutter with all its advantages and producing a machine to generate a theoretically correct tooth in a bevel gear by the use of such a cutter.

Mr. Beale came to the shop one Saturday morning and told several of us that he had developed an important in-

vention during the night. He said that he had waked up suddenly with his mind concentrated on matters of gear cutting and that the conception of this machine came to him clearly and without effort on his part. He felt its importance to such a degree that he arose and made a memorandum of what had come to him in such a surprising manner, in order that it might not leave him.

The next morning, when explaining to me the invention, he made the sketch shown in Fig. 6, which bears the date and his autograph signature. Mr. Beale lost no time in developing this invention as he worked out the main features that same morning and considered the design well completed when during the afternoon of the same day, he had perfected the design of the cutter. Some machines after this design were built and are now in use. One was exhibited at the Universal Exposition at Liège, Belgium, in 1905 and there attracted much attention.

While as a rule Mr. Beale was methodical and painstaking in whatever he had to do, the illustration just cited was not the only case of his quick perception of the way to accomplish the desired results. I remember once when we were working up a quick return for the table of our milling machines, several designs had been laid out but each had some drawback, such as making the crank turn the wrong way, or requiring too many gears. I explained to Mr. Beale our difficulties and almost before the explanation could be completed he said; "Have you tried an internal gear? It will keep the direction right, use few parts, and be its own gear guard." This suggestion was successfully incorporated.

Work in Producing Standards of Measurement

Probably the most important part of Mr. Beale's work was in connection with producing standards of measurement for use in the shop, and in devising ways of using such standards to bring about a higher degree of accuracy in workmanship.

Joseph R. Brown, the senior partner of the Brown & Sharpe company had, by the year 1869 when Mr. Beale entered the employ of that company, already done much to raise the standard of accuracy in the manufacture of mechanical products. The universal milling machine had been invented by him and was then being built for the market. The universal grinding machine, another of his inventions, was in embryo. The formed cutter, also his invention made it possible to retain the form of the cutter when grinding, thus materially advancing the art of accurate gear cutting as well as other mechanical work.

The American wire gage first proposed by Brown & Sharpe, was being put on the market together with many other forms of gages and standards to develop a higher degree of accuracy. The micrometer caliper was first introduced into America about this time and, together with a line of Vernier calipers, measuring scales, squares, etc., constituted a line of manufacture, which gradually crowded out the clock business which had been the original line of work in the days of David Brown, the founder.

It was under such conditions and at such a time that Mr. Beale came to Providence and was hired as a machinist by Edward H. Parks, then contractor with the Brown & Sharpe company. The reputation of his new employers for accuracy and high-grade work had reached him in the country shops where he had been working. He had heard of a wonderful machine called the universal milling machine, but had never seen one until he saw it for the first time in the shop of its birth. He says that it was with something of awe that he first saw and operated one of these machines.

It was natural too that Mr. Beale should look with deference to Mr. Brown, whose mechanical inventions had given him such a reputation, and that he should be impressed with and give great weight to what Mr. Brown said and did. The shop being small, it was not long before these two men were brought together and Mr. Beale began to absorb some of Mr. Brown's ideas and plans in mechanical lines, including those for further attainments of accuracy.

Some of the latter matters to which Mr. Brown was giving his attention were the dividing of a circle, the dividing of a straight line and the threading of a screw, all to be used as masters for commercial work, and before the death of Mr. Brown in 1876 Mr. Beale had acquired much from him which he was in a position later to make use of in carrying these plans to completion.

Making a Standard Screw Lathe

In 1885 Mr. Beale was assigned the task of producing a standard screw lathe. In speaking about the difficulties encountered, he quoted Mr. Brown as having said: "The true story of the originating of the screw is probably lost in the long and shadowy past. It would be interesting reading but in our time it is better to take as good a screw as we can readily find and begin where someone else left off."

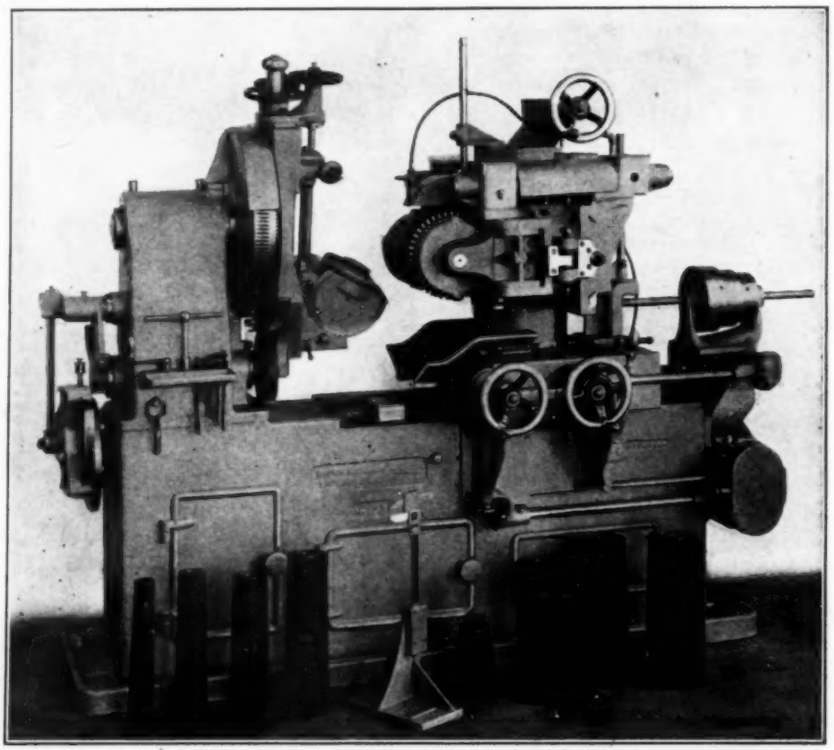


Fig. 5. Bevel-gear Generating Machine Developed by Mr. Beale

This was the plan adopted under Mr. Beale's direction but even then it was a long and uphill task. The goal set was to produce a lathe in which a screw could be commercially cut within 0.0004 in. in one foot, or within 0.001 in. in four feet; the lathe to cut screws up to about five feet long without fleeting and having provision for fleeting the screw being cut, so that much longer screws could be cut. (This lathe has since been used for cutting precision screws up to more than thirty feet long.)

Mr. Beale's originality in design was here shown in breaking entirely away from the conventional lines of the lathe and making a machine every detail of which was directed to producing an accurate screw.

The work of producing a master screw and a working lead screw for this lathe would be a long story in itself but it will suffice here to say that Mr. Beale "lived with the job" and brought all his skill and experience, together with an infinite patience, to the task until it was successfully accomplished, indeed so well accomplished that the actual product is materially better than the limits set.

Following the design of this standard screw lathe and associated with it the question of standards for linear measure and methods of comparing work with such standards began to have a large part in Mr. Beale's thoughts and led next to the designing of a comparator

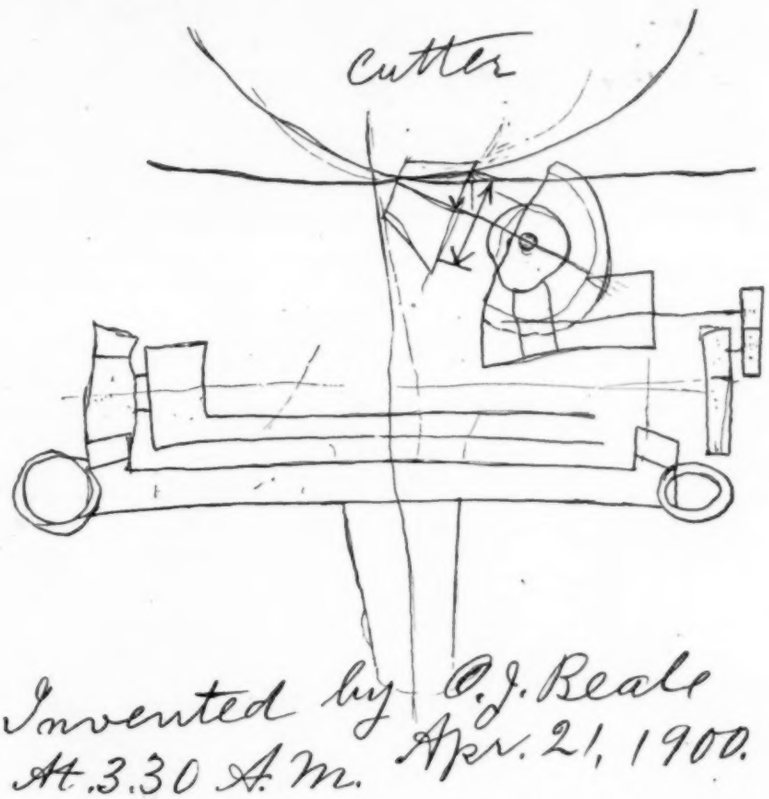


FIG. 6. ORIGINAL SKETCH OF GEAR- CUTTING MACHINE MADE BY MR. BEALE

to compare a screw and a scale, also scales with each other under the microscope.

THE MEASURING MACHINE

The measuring machine shown in Fig. 7 is another machine designed by Mr. Beale for accurately measuring commercial work. This machine has a scale with lines of microscopic width and spaced to a high degree of accuracy. The reading is to within 0.00001 in.

It was to produce a standard from which such working copies could be accurately made that Mr. Beale was commissioned to make and subdivide the standard yard and meter. As in the case of the screw, the work was undertaken by selecting the best standard available. use of lines was made about this time by Samuel Darling, who attempted to subdivide the yard into eighteen equal parts by means of adjustable pieces held in a groove in a bar about forty inches long. Each of these adjustable pieces had a line upon it and the plan was to adjust the two outer pieces so that the lines would be just a yard apart; next, to adjust the middle piece so as to divide the yard into two equal parts and then to divide each half yard into three equal parts, and each of these into three other parts.

This method did not prove successful and was abandoned. As the calls became more frequent for standards with a high degree of accuracy, a further effort was made to produce a standard to

with its known errors, and patiently and skillfully eliminating those errors.

Brown & Sharpe for many years prior to this, had linear standards, used as a basis of their measurements. These had been compared with the government standards at Washington so that their errors were known. The original standard for length was a bar for end measuring and it was not until after 1875 that a method was adopted using microscopes set to line graduations for comparing measurements.

PRODUCING A STANDARD YARD

An attempt to produce a standard yard and to subdivide it accurately by the give the required degree of accuracy without so much correction being required. Such a standard was made in the form of a nickel-plated steel bar with graduations upon it. This was compared at Washington with the government standards: "Bronze No. 11 and Low-Moor-Iron No. 57.

This bar was the subject of much correspondence with the Government Office of Weights and Measures which was at that time connected with the United States Coast and Geodetic Survey. The reason for this correspondence was that a number of comparisons showed so much variation from each other that it was uncertain as to what was the real length of the yard on this nickel-plated bar. J. E. Hilgard, then in charge of the Office of Weights and Measures, laid the variations to the use of nickel plating and its unequal expansion and contraction as compared with steel. The method of supporting the bar also came into discussion as to the cause of variations.

While this standard was an improvement over the earlier use of an end measure, the fact that a degree of uncertainty existed regarding its length as compared with the standards at Washington led Brown & Sharpe to commission Mr. Beale to produce new standards for the yard and meter and to accurately subdivide them.

It was desired to have the improved standards on bars of such material and with lines of such fineness and smoothness as would give more exact results; also with variations still further eliminated so as to simplify the work of comparison. The preparation for, and carrying out of this work, occupied several years and was done in the same painstaking manner as for producing a precision master screw. The results were the standard yard and meter which now form the basis of measurement at these works.

These standards, after being completed were compared with those at Washington and the mean errors were found to be for the yard 0.00002 in., and for the meter 0.000005 m., both being too long. This is a variation which for the yard would disappear with a reduction of temperature of less than one-tenth degree F., a variation so small that with the most painstaking methods, through a series of measurements by experts at Washington the variations between different measurements were greater than this error and the final result was derived by averaging a number of different measurements.

Another way of trying to bring within human conception such minute distances is to think of the space moved on a Vernier caliper to change its setting a thousandth of an inch and then to realize that a variation of 0.00002 in. is one-fiftieth of that amount.

Following the production of the standard yard came its reproduction for work-

ing standards and its subdivision into inches. This was done so accurately that some experts pronounced it perfect after many examinations. The lines are on a bar having forty inches graduated; hence it contains five different yards.

Mr. Beale was also the designer of graduating machines for rules, both soft and tempered, used in the production of commercial work. That he was even more critical of his own work than were others is shown by an incident connected with the first development of these machines. A slight deflection occurred as the lines entered the stock and Mr. Beale nicknamed these lines "shepherd's crooks" and "shinny sticks," thus drawing down on his head the displeasure of the management for exaggerating the trouble

Producing Accurately Spaced Circles

In producing accurately spaced circles as a basis for circular graduating and as a step toward the production of precision index wormwheels, Mr. Beale's experience and skill were again called into play. As a first step a circle about 40 in. in diameter was divided by a famous manufacture of instruments of precision. The results were disappointing and here, as in the cases of the screw and scale, it became a matter of slow and repeated work in making corrections so that a more accurate spacing was obtained after each trial, resulting finally in the required degree of accuracy.

Mr. Beale followed the production of the accurately divided circle by inventing and constructing a series of machines for accurately cutting the teeth of wormwheels, and for precision index drilling, hobbing and circular graduating. In connection with the designing of graduating machines he designed a large number of related machines also required for the production of scales and precision tools such as grinders, etc., such as the equipment for, and methods of handling, this class of work.

A Few Well Remembered Traits

Combined with the profound thought and painstaking labor required to bring about such successful results, Mr. Beale showed a simplicity of character at times almost amounting to timidity and which sometimes led him to be imposed upon; with this, however, he had a sense of humor, which, although not always spontaneous, was real.

Once when he was explaining the involute curve to a visitor, he said: "The involute curve is an epicycloidal curve with a generating circle of *infinite radius*." To show what he meant, he swept his arm about in a circle rising on tiptoe and reaching to his greatest limit and said: "I cannot *quite* reach but this will illustrate." At another time, using his finger as a pointer, he was describing the working of an epicyclic train to a visitor and was frequently interrupted. At each interruption he patiently kept his finger on the spot where he left off and when given an opportunity, carried on the explanation from that point, making his purpose so evident that the visitor remembered it and reminded him of it years afterward.

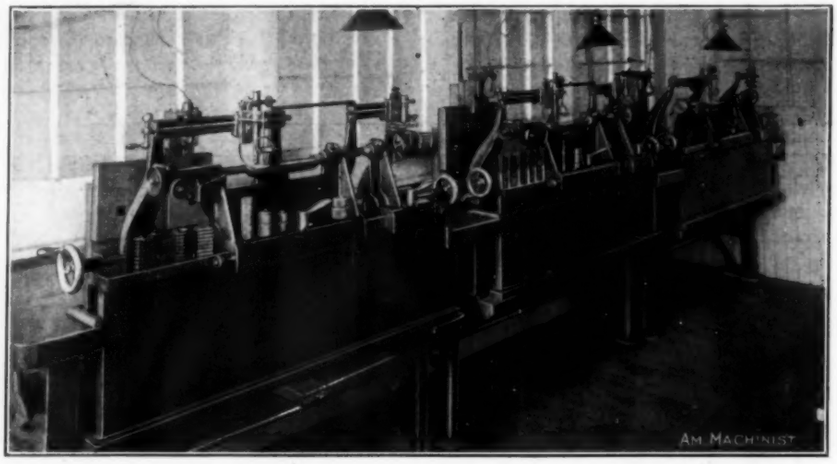


Fig. 7. Group of Measuring Machines Originally Designed by Mr. Beale for Reading to Within 0.0001 Inch

He was a man of simple habits, sensitive to a degree which made him retiring in society, but companionable among his acquaintances, with a fund of stored-up knowledge, accurately remembered, so that he could talk, not only intelligently but authoritatively on many subjects, this because he was a thorough student of subjects in which he was interested or in which he had responsibility. He was a natural mathematician of a high order; an eminent mechanic by training and intuition, with a power to analyze a mechanical situation and to apply the right principles to its solution, a painstaking and accurate writer, leaving behind an accomplished life work that has materially advanced the mechanical interests of the world.

Fig. 8. Mr. Beale as He Appeared at the Shop During His Later Years

Compulsory Licensing of Patents

In a hearing before the House Patent Committee Spencer Miller, chief engineer of the Lidgerwood Manufacturing Co., New York, N. Y., testified in opposition to the proposed bill R. H. 23,417.

Referring to his own experience, Mr. Miller declared that before the financial management of his company would consent to finance his apparatus for coaling warships at sea, it was necessary for him to show that he proposed to take out a series of hedging patents covering not only the most approved form but all other methods which might be possible and that might be discovered later on by others. The venture was successful from a technical standpoint but cost between $40,000 and $50,000 to produce a machine which sold for $8000.

Had this proposed bill been on the statute books at that time, this company would have refused to finance the undertaking on the ground that it would only be entitled to patents on the particular class of machine which it built and that alternate types might be built by competitors after demanding a compulsory license under the unused patents.

Rise of German Factory Schools

By Kurt Kohlmann

International competition, high precision of products, and a desire to check the emigration of available workmen, factors in the creation of Germany's institutional and shop vocational training. Attendance at continuation schools mandatory. Factory schools that offer supplementary training, and a suggestion that the Imperial Government subsidize them.

Up to the middle of the last century Germany was still a country which exported hundreds of thousands of people a year, because the agricultural industry which there predominated was insufficient to support even the comparatively small natural increase of population. A change first entered with the strengthening of German manufacturing industries, which constantly required new laboring forces and which, after the foundation of the German empire, established relations all over the world.

The births yearly exceed the deaths by almost a million, and in addition the labor markets constantly demand a very considerable immigration of Polish, Slav and Italian elements, while the emigration has sunk to 15,000 or 16,000 persons.

Thus we are exporting goods which increase the power of the national empire, and the times are permanently at an end when Germany was financially and physically weakening itself by sending abroad its most efficient forces, and this commonly at the age of life when a man is most capable. From 1882 to 1907 the percentage of people employed in agriculture sank from 42.5 to 28.6 per cent., while those engaged in industry, trade and commerce rose from 45.5 to 56.2 per cent.

Development of German Industries

Of interest in this connection is the accompanying phenomenon that the development of large industries unceasingly progresses, and this is associated with the good general education that fosters the great increase of German exports. From 1895 to 1907 the number of persons employed in the so called dwarf industries (one-man industries) fell off about 7.2 per cent., but the larger the work the greater is the percentage increase of those engaged in it. In medium factories, employing from 6 to 50 persons this increase is 51.7 per cent.; in large works with 51 to 500 persons, 71.1 per cent., and in large works of over one thousand persons, 109.8 per cent.

A working army of almost nine million was shown by the vocational census of 1907 to be active in the German industries, but this number of persons is still more significant if we consider that among them about one and a half million, that is about one-sixth of the whole, stand at the youthful ages of 14 to 18 years.

If we bear in mind the fact that upon this growing generation the future of the German industries rests, that the intelligence and skill of these young people must one day place upon the world's markets products which will successfully contend with foreign competition, the question spontaneously arises: "How are these masses being educated in their trades, both practically and theoretically?"

Reference must first be made to our public schools, which are recognized as good ones, but whose object can be only to educate the members of future generations into useful men and women, affording them primarily a good general instruction and character development.

With such learning the workmen up to even a few decades ago were well prepared to take up the simple machines then offered them, the working force itself then being not very highly valued and, therefore, not conditioned by especially high efficiency.*

The situation changed with the sharp international competition soon setting in. An uncommonly high precision of product, particularly in the metal-working trades, became necessary if rational manufacture was to be insured; the rising wages imperatively demanded economy with the human working forces and therewith the introduction of finer and more complicated machinery requiring for each operative almost a special education.

For this education the public-school training was naturally no longer sufficient; a practical and theoretical vocational training had to follow. We thus see, beginning with the middle of the last century, the development into trade schools, of the Sunday schools originally dedicated to religious instruction. Subsequently there arose societies which called into life business and commercial continuation schools, drawing schools, handwork and various trade schools.

Beginning of Obligatory Attendance

Many municipalities followed the example of these societies and in the seventies of the last century, attendance at continuation schools became obligatory, under the statutes of many German states.

South Germany has in recent years been a pattern in this respect. The Wurttemberg public school statute of Aug. 17, 1909, requires that general continuation schools must be established by all the municipalities for the male youth as soon as 40 scholars are available, and that the yearly time of instruction must comprise at least 280 hours. The compulsory school age is up to 18 years. In Hesse is prescribed a three-year school of 40 weeks per year and six hours weekly.

Prussia also considered the statutory regulation of attendance at continuation schools established by municipalities. The project, however, failed, because of a disagreement among the legislators on the question of religious instruction. The largest German state therefore, still remains dependent upon the municipalities.

Beginning of Factory Schools

Despite the growing specialization of German industry, and its progressive demands upon theoretical trade training, its needs in clearly defined educational provinces are often inadequately met, even by well conducted continuation schools. Therefore resort is had to various excellent methods of self-assistance. Thus, factory or shop schools have been established by many large works and also, very gradually, by a whole series of plants which do not belong to the so called giant industries.

A study of their developments involves the presentation of a series of important figures and data, of the highest general interest, and expressing the concise opinion that this branch of education is doubtless destined to a great future.

Statistics of Factory Schools

The following statistics are for Prussia up to March, 1911:

1906..42 factory schools with 4841 scholars
1907..32 factory schools with 4140 scholars
1908..54 factory schools with 5741 scholars

In the meantime, the number of factory schools existing in Germany has grown to 78, of which 69 are in Prussia and North Germany, three in Saxony, four in Bavaria and two in the Imperial province, Alsace-Lorraine. Figures obtained regarding 68 of these schools show the number of pupils to be 7784, who are vocationally distributed according to the following table:

	Prussia and North Germany	Bavaria	Saxony	Alsace-Lorraine	Total
Metal-working apprentices	2149	274	304	115	2842
Founder and molder apprentices	440	41	98	13	592
Pattern maker apprentices	98	30	16	10	154
Other trade apprentices	321	12	8	...	341
Drafting apprentices	145	9	71	11	236
Commercial apprentices	42	4	5	4	55
Unskilled workmen	3397	...	167	...	3564
Grand total	6592	370	669	53	7784

*This inverts our usual presumption that a higher degree of personal skill was found in the old-time machinist than in the modern machine operator.—Editor.

The trade apprentices (drafting and commercial excluded), with 3929 persons stand against 3564 unskilled workmen who receive continuation instruction at factory schools. This opportunity may be taken to define the term trade apprentice, as generally used, to comprise such various young people as combined trade continuation study with a three- or four-year period of trade apprenticeship, while the unskilled workmen do not do so, but rather adopt certain lines of work, as, for example, the rivet heaters. Accordingly the latter frequently change their places of work until they outgrow the age of obligatory continuation schooling, which naturally has an important bearing on the work of the shop schools. We therefore find exclusively unskilled workmen in only 12 of the schools named, and these are generally encountered in mining. In 31 schools, only apprentices are instructed, in 25 schools both classes together.

Subjects Taught

This fact naturally affects the distribution and form of the study courses, since in works schools whose pupils are exclusively or chiefly unskilled workmen, the theoretical instruction should, to an important extent, be made to comprise German studies, arithmetic and civics or public affairs, which latter department gradually will overcome the abiding ignorance of many large classes of society on public questions.

In the apprentice schools, on the contrary, there is imparted to the pupil through three or four years, embracing six to ten hours of study a week, a sufficiency of general and special knowledge, which proves to him how much the employer has at heart his intellectual progress.

Beside German, writing, reading bookkeeping, arithmetic and mathematics, we find civics, law, political economy, hygiene, planimetry, solid geometry and trigonometry. In addition to mechanics, statics, thermics, chemistry and electricity are also business methods, technology, shop practice, mining, etc. Drawing is, of course, generally a chief subject, while gymnastics and singing are less often represented. Following is a classified list of subjects taught:

In 58 schools, German, reading, writing and related subjects
In 7 schools, bookkeeping and business methods
In 23 schools, civics and legal topics
In 26 schools, history and geography
In 60 schools, arithmetic
In 6 schools, mathematics and algebra
In 23 schools, geometry
In 37 schools, natural and special subjects
In 4 schools, chemistry
In 39 schools, drawing
In 4 schools, gymnastics, singing and play

Beside the sort of pupil, the selection of courses of study naturally answers to the specialty of the work. Among the firms which have established factory schools, the mechanical industries far preponderate, with 36, next comes mining with 19, the furnace and iron-works industry with 9, and then the chemical, furniture, textile and stone and earthenwork industries with one school each.

Success of These Factory Schools

That the unanimous judgment of these works, on the success of their schools, is a good one, need to be no surprise when it is considered that these factory schools have been planned in a very special manner to train the workmen directly for the special tasks awaiting them, and to supply them with the theoretical knowledge especially necessary in the individual factory concerned.

Hand in hand therewith are the experienced factory officials as special instructors. Besides these special instructors, there are also in factory schools some professional teachers, as shown in the following partial tabulation:

	Professional Teachers	Nonprofessional Teachers
Mining	100	10
Iron industry	51	37
Mechanical industry	21	87
	172	134

Altogether in the 68 factory schools referred to, there are at work 189 professional teachers, and 145 nonprofessional teachers. The first are usually occupied with instruction in German, arithmetic, civics, etc., while the latter, as already mentioned, can in a most ideal manner, impart a theoretical knowledge to the same young people with whom they deal in the shop.

That all these men receive a special compensation for their work of teaching goes without saying, which is a condition often cited in interested circles against the establishment of factory schools. The fee for each hour of instruction varies between two and five marks, beside which the cost of school supplies, rooms, lighting, heating and cleaning must be considered, so that all told the German industry spends about a quarter of a million marks ($60,000) for its factory schools.

This certainly is a respectable sum, which, however, considered by the results attained, is by no means uneconomically expended. On the other hand, although the expenditures for scholars in mining amount on the average to 21 marks, in the industries to 27 marks and in mechanical industries to 42 marks, still these are below the costs which the municipalities have to sustain for their continuation schools.

Finally, it can be only a question of time when the government will no longer regard its approval of the establishment of new factory schools as a favor, but will consider such schools as a substitute for the compulsory continuation schools and will be thankful to those who have offered their trouble in the interest of the general welfare.

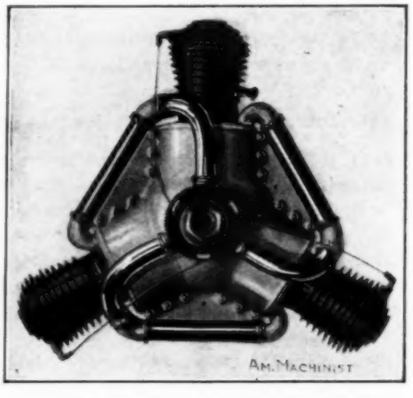
This appreciation can be expressed in no better way than by government subsidies to the factory schools, whether in bare money or by providing suitable rooms for instruction, etc. Not until then will these institutions, these products of German foresight, develop to their full stature, for the reputation of Germany and imitation abroad.

New Motor for Aeroplanes

By Edward Leymarie

A motor for aëroplanes, recently brought out in France, is known as the "Laviator, type A." It is a two-cycle engine with three cylinders, placed radially 120 deg. apart.

Each unit of the motor is composed of a pump and a cylinder. Each pump moves 120 deg. in advance of the cylinder it feeds, and each pump is connected to the cylinder it feeds by a pipe. On the other side it is connected to the carburetor by a pipe and a circular distributor. The fixed part of this distributor is formed by the hollow crankshaft, the wall of which is perforated with distribution ports.



The Laviator Aeroplane Motor

Finally, the pump is connected to the inside of the crank case by the tube, the distributor and the crankshaft, by means of a second port series pierced in the shaft on the other side of the partition from the gas ports. The interior of the casing communicates with the external air by the wormshaft, which is hollow.

The Laviator motor with three cylinders gives three ignitions per revolution. It possesses, therefore, the cyclic regularity of a six-cylinder, four-stroke-cycle engine. It comprises no part whose motion is not positive.

Ammonia is reported to give excellent results in removing gummed oil from the polished parts of machinery. Rubbed over the parts with waste, it acts as a good cleansing agent, and on parts not easily accessible with waste, it is equally efficacious when applied with a brush.

The Factory Fire Brigade and Drills

Editorial Correspondence

Organization, personnel and duties of the shop fire brigade. Its efficiency is dependent upon the frequency and nature of the fire drills.

The safety of the employees is directly dependent upon sufficient exits. That these may be used effectively in case of fire, factory fire drills or "exit drills" should be held frequently. The organization and method of conducting such drills are given in detail.

For the benefit of our readers who desire to organize private fire brigades and fire drills in their factories, we present the lines of organization adopted by the National Fire Protection Association, at its recent convention. It is safe to organize fire brigades in buildings of only one or two floors. Beyond this limit, the employees should be trained to give their attention only to incipient fires that can be quickly quenched by means of a bucket or by the ordinary fire extinguisher. The workmen on the upper floors of the building should be taught to leave the instant that the fire shows indications of growing to greater proportions. Slight delay on their part is very likely to cost their lives.

The organization and training of the private fire brigade is one of the most important problems in the field of fire protection. Fire pumps and distribution systems, however perfect, will prove of small value if we neglect the means by which their possibilities are to be realized.

Frequently in laying out systems of fire protection the organization of the fire brigade fails to receive the consideration which its importance deserves. It would seem but simple business economy that the means whereby the expenditure for pumps, water mains and hydrants is to be made effective, should be developed to its highest efficiency, for in any system of fire protection, working efficiency will depend largely on the skill with which it is handled.

Aside from its primary object, the private fire brigade has possibilities for the alert mill manager or factory superintendent in promoting amicable relations between the management and employees. If properly developed it will amply repay any reasonable expenditure of time and energy given to its organization.

The motive underlying a fire-brigade organization is fundamentally one of mutual protection; to the manager, the safeguarding and preservation of his plant; to the employee, the permanency of work and wage. When this relationship is properly understood and the interest of each party made the common interest of both, we have then laid the foundation for a successful and efficient organization.

Membership in the brigade should of itself confer distinction and, if possible, carry with it the exercise of some minor privilege sufficiently attractive to make membership desirable and sought after.

The ideal private fire brigade should be organized under a constitution, with its own bylaws and with provision for regular meetings. The conduct of the men should be subject to discipline, and in the same manner acts of unusual merit, involving personal risk and endurance, should be fittingly rewarded.

The degree of efficiency of a brigade organization will be almost in exact proportion to the care and judgment exercised in the selection of men. Careful selection will involve judgment in the reading and discernment of character and a somewhat intimate knowledge of the men and their personal habits. The plant superintendent, in performing this important duty, should have the assistance of the shop foreman and subheads of departments; the final judgment, however, should be that of the superintendent.

Selecting Men for the Brigade

In the work of selection, the first consideration is loyalty. Only those men whose sympathies and interests are well known should be considered. Fitness for fire-brigade service requires a peculiar combination of physical stamina and judgment—a strong, robust constitution, with sight and hearing unimparied and with somewhat more than ordinary powers of endurance. The ability to decide quickly in emergencies and a high degree of self-possession are qualities most desirable, although fitness should not depend on these alone.

Consideration should be given to: Age (ranging between 18 and 45 years). The ability to speak and readily understand English. A general knowledge of the character of construction and occupancy of the building or plant, including the location of stairways, elevator shafts, and the means of approach to attics and basements. The proximity of place of residence to the building or plant, and previous experience in fire-department work.

The chief of brigade should be someone high in authority whose duties would insure his presence at the plant the greater part of the time, preferably the master mechanic, the factory manager, or his active assistant. Someone whose position would command the respect of the men and give reasonable assurance of official recognition for meritorious service.

The selection of the assistant chief should be governed by circumstances. Should the chief selected have a general working knowledge of fire protection, the assistant chief may be chosen with reference to his position in the administration of the plant or store. Otherwise the assistant chief should have some practical fire knowledge or mechanical training and experience.

For captains of companies, men with mechanical knowledge are to be preferred, either shop foremen or regularly employed mechanics.

In addition to the foregoing qualifications the men selected should be of sound and reliable judgment, capable of acting quickly in emergencies, as upon these men devolves direct supervision of active fire operations, and care in their selection is of the utmost importance.

Company organization should be designed to afford the men respective duties. and experience in their respective duties. For the average shop plant there should be three separate companies; namely, hose, chemical engine and ladder company. Where the buildings are provided with a complete equipment of stationary ladders the latter company may be dispensed with.

In addition to these companies a special detail of selected men should be designated to handle chemical extinguishers, fire pails and any other equipment. This latter provision should not interfere with the desirable feature of having all employees thoroughly familiar with the use and handling of this equipment.

A salvage corps, consisting of from six to twelve men (according to the size of the plant or store) should be maintained, whose special duties should consist of protecting stock and machinery from water damage, both during and after a fire. For this work, men of average intelligence are required, who should be especially instructed as to the proper course to be followed in preventing needless water damage. The corps should be provided with rubber covers and other accessories as the nature of the contents may require.

Assignment of Men and Duties

Hose Company—The minimum requirement for a hose company will vary with local conditions, but in no case should there be less than eight men, including captain. For the more extensive plants and for the plants having buildings of large areas, the organization can be ex-

panded accordingly, depending largely upon the maximum number of hose streams to be used.

Hydrant Men—Two men should be selected for each hose stream. One man to remain at the hydrant to turn the water on and off, the other to assist in unreeling hose, making couplings and aiding in taking out the hose.

In the runs to fires, hydrant men should take position in the rear of the hose wagon, one man (where hydrants are not provided with wrenches or handwheels) with spanner to drop off on reaching the hydrant, the other going forward with the hose wagon, to assist in unreeling the hose and laying the line.

Pipe Director and Pipe Men—This service requires strong, able men, capable of carrying pipe and hose up roof ladders, while under pressure, and with endurance to withstand the noxious effects of smoke.

Three men are required for each hose line, one of whom to be designated as the "Pipe Director" should be in charge of the pipe. While nozzle rests and other devices may be employed to control the pipe by one man, the two additional men specified will be necessary in placing and moving the pipe and in drawing the line up ladders and over roofs. The pipemen in runs to fires should be on the tongue of the hose wagon and assist in disconnecting hose and attaching the nozzle.

Extra Hosemen—Not less than two extra hosemen should be attached to each company, to assist in drawing the wagon and in laying the hose line.

The Ladder Company—As the practice of providing stationary ladders on buildings of shops and industrial plants is now general, ladder-company service will be confined to those plants not so equipped, or where the equipment is incomplete.

The ladder company should be organized with a complement of not less than nine men, including a foreman. The exact number will vary with conditions, depending upon the height of the buildings, the degree of exposure and the character of construction.

Under direction of the foreman, the company should have entire charge of the truck and ladder equipment, subject to the orders of the chief and assistant chief of the brigade. The duties of the ladder company should consist of placing and running ladders, handling and use of chemical extinguishers from the truck's equipment, and the opening of roofs, floors, partitions, etc., as may be necessary to play the hose streams, in addition to such other duties as in the judgment of the chief may be necessary.

Chemical Engine Company—To consist of five men, including a captain. Two tankmen should have charge of operating the engine tank; to open and close the main-tank valve in addition to agitating and mixing the chemical charge, and of recharging. The men should be thoroughly experienced in both the principle and method of operating the engine and should be held responsible for the proper charging and condition of the tank at all times, also for having the necessary extra charges on hand.

Nozzlemen—Two men should be selected to carry and direct the nozzle and to assist in unreeling the hose and laying the hose line. For engines having two tanks, an additional tankman and nozzleman should be provided. These men are mainly necessary to assist in drawing the engine.

Standpipe company—For factories, equipped with an interior standpipe system, a separate company should be organized to operate it and handle the hose lines connected therewith.

This company should comprise not less than 16 men, or a sufficient number to concentrate four hose lines on any one floor, or, where less than four connections are available, there should be a sufficient number of men to man all the lines.

The company should be in command of a captain, in direct charge; and for each hose stream there should be a valveman and two pipemen. The valveman should remain at the hose gate to turn the water on and off, and assist in unreeling the hose. The pipemen are to handle, and direct the pipe, and assist in unreeling the hose line.

Hoseman—For each hose stream opened there should be one extra man available to assist, if necessary, in unreeling hose or in directing the pipe.

Where standpipe systems are supplied from gravity tanks or by means of connections with public mains, the organization should provide for a "main valveman," who shall be charged with the duty of seeing that the shutoff valve between the source of supply and the standpipe system is open and in good working order.

For all factories there should be certain members of the fire brigade designated to unreel hose connected with inside hydrants or standpipe systems, and to stretch it carefully on all floors.

Attach to each fire-brigade organization there should be an experienced plumber, selected from those connected with the plant, preferably one familiar with the distribution system and with the location and operation of all valves. Where electric current is used, provision should also be made for the attendance at all fires of a practical electrician, having first-hand knowledge of all conductors, their voltage and of the location and operation of all protective devices. These men should report to the chief or assistant chief, and be subject to his orders.

At plants where the fire service is supplied by pumps, it is advisable to have the engineer in charge and his assistants enrolled in the fire-brigade membership, in order that they may be in close touch with the purposes and objects of the brigade. During fires and fire drills, the engineer and assistant should remain on duty at the pumps.

Fire Drills for Fire Service

High efficiency for a fire brigade will depend upon the frequency and character of the fire drills. These drills should have two objects: Promptness in reaching the point of fire by designated routes, and practice in handling the apparatus. To effect both objects, two distinct methods should be followed in arranging alarms:

First,: Alarms should be sounded periodically at irregular intervals and at a time unknown to the men.

Second: There should be, in addition to the periodical alarms, an alarm at regular stated intervals, semi-monthly, at a time known to the men in advance. These latter drills should be, according to a prearranged schedule, at an hour suited to the convenience of the business or plant operation. The drills being designed for practice work with the apparatus will consume somewhat more time, as they will practically afford the only means the men will have for training in fire-department work.

When shop or other industrial plants are operated at night, provision should be made for fire drills similar to those for the day forces. Frequently for large plants remote from city or town protection, operating only a day shift, efficient night fire-brigade service may be had by organizing and drilling the watchmen, cleaners and repair men, who may be regularly employed at night. These men should be subject to the same general rules governing the day brigade and regularly drilled to insure efficient handling of all apparatus.

For the regular semi-monthly drills, the brigade work in the handling of apparatus should be thorough in every respect, closely approximating actual fire conditions. It should embrace the making of connections of hydrants, unreeling and stretching hose, breaking and making couplings, carrying hose up ladders and over roofs and through the interior of buildings, reaching at various times inaccessible and out-of-the-way places, including sub-basements, basements, attics and all concealed floor and wall spaces.

The drills should cover all buildings and departments in order that the men may acquire an intimate knowledge of the interior arrangement and construction, including stairways, exits and elevator shafts, together with the location of all hydrants and connections.

It is important that the men should be-

come practiced in holding the playpipe and in moving and carrying the hose line while under pressure and, as a general rule, water should be turned on for all practice work, except during freezing weather. At times, when conditions are favorable, a sufficient number of hose lines should be stretched to test the maximum working capacity of the distribution system.

The presence of aërial electric conductors near a plant or building may operate to hinder the work of the fire brigade through fear of the consequence of contact with the hose stream. In order that the men may not be unnecessarily exposed to these dangers, and at the same time that the actual danger may not be overestimated, and thereby delay the work of fire extinguishment, it is important that the men be fully informed of actual conditions, and where assured of competent direction during practice work it would be of considerable advantage to give demonstrations on these conductors where they would be no harmful result.

It has been shown as a result of a series of tests that hose streams of fresh water may be played on alternating-current conductors under certain conditions without injury to the pipemen. With a 1-in. nozzle at a distance of 10 ft. from an alternating-current conductor, carrying 4600 volts, there was no appreciable effect beyond a slight indication of static electricity. In these tests one side of the circuit was thoroughly grounded and the fire stream played on the other side, which was suspended in the air and thoroughly insulated.

Factory Fire, or Exit Drill

Organization and Duties—All factory drills should be subject to the direction of a supervisory organization constituted as follows: Chief of fire drill, floor chiefs, room captains, stairway guards and inspectors. These positions preferably to be filled by male employees wherever possible.

Chief of Fire Drill—This officer should be someone whose position would command respect and insure compliance with all orders and instructions relating to fire drills.

Duties of Chief of Fire Drill—He should have general charge of all matters pertaining to fire drills, practice maneuvers and organization, and designate those persons to fill the positions above mentioned. He should fix the time for holding drills and rigidly enforce measures of discipline for failure on the part of any employee to fully observe all the rules and requirements. By personal inspection he should see that overcrowding in workrooms is prevented and that sufficient space is given to aisles and passageways to permit quick access in reaching all of the exits.

Floor Chiefs—Care should be exercised in the selection of these men, as upon them largely depends the efficiency and success of the drill. Where department foremen or factory superintendents possess the requisite qualifications their selection is to be preferred. It is important, however, that they be men having the trust and confidence of their employees generally, with a fair degree of self-possession and capable of speaking the language of the operatives.

Duties of Floor Chiefs—The floor chief should have immediate charge of all operatives employed on his floor in all matters pertaining to fire drills. He should be held responsible for the enforcement of all fire-drill rules and report to the chief of fire drill any employee who willfully neglects their proper observance.

He should see that each movement corresponding to the alarm signal is promptly and orderly executed, and personally supervise the sounding of the general building alarm on his floor. He should be further responsible for the condition of all aisles and passageways and should see that chairs, benches and stock are promptly removed to insure unobstructed passage.

When, by prearrangement in drill practice or as a result of actual fire, it may be necessary to depart from the regular instructions as regards selection and use of exits, such change should be at the sole direction of the floor chief.

Room Captains—Whenever floors are subdivided into two or more rooms the floor chief should be assisted by the room captains. For floors of large area, the floor captains should designate a drill supervisor for every 50 employees, to assist in maintaining the necessary control and discipline. For these latter positions, where men with the required qualifications are not available, selections should be made from the forewomen.

Room captains should be chosen from those highest in authority, preferably a foreman or work boss. The same general care in their selection should be exercised as indicated for the floor chiefs.

Duties of Room Captains—They should perform the same general duties in their respective rooms as are prescribed for the floor chief, subject to the latter's direction and supervision, excepting that they should have no authority to change the assignment of exits, nor sound the general building alarm unless under direction of the floor chief. Where rooms are equipped with drill gongs the room captains should personally sound the alarm thereon.

Stairway Guards—For these positions men are to be preferred they should be strong and alert, capable of acting quickly in emergencies. Two men selected from each floor should be assigned to each exit or stairway.

Duties of Guards—Guards should be subject to the orders of the floor chief or room captains and should see that the march from the rooms and descending the stairway is orderly and without crowding and at uniform speed, with careful observance of spacing between files. They should be especially watchful of persons stumbling or falling to prevent trampling and should be given authority to halt the line where conditions require.

Guards should be stationed as follows: One guard on the stair side of the door leading from the room and one guard midway on the staircase leading to the floor below. Where stair exits have sharp bends, or are poorly lighted, additional guards should be provided as required.

On fire escapes where conditions permit, the arrangement should be similar to that outlined for stairways, with the exception that the guards should be stationed on the balconies or platforms instead of midway between the floors. In this connection it is believed that when inclined ladders are used for fire escapes, provision should be made for erecting a small swinging platform inclosed by a guard rail in order to permit stationing guards at advantageous points.

Inspectors—An inspector selected from among the operatives should be appointed to examine, each morning, the condition of all stairways, fire escapes, and roof exits, if any, and to report immediately to the chief of fire drill any obstruction found thereon or any other unusual conditions. He should also see that all doors leading to stairways or exits open outwardly and immediately report any found locked or obstructed to the floor chief or chief of fire drill.

During the winter attention should be given to fire escapes where exposed to accumulations of ice or snow, and, whenever found so encumbered, immediate steps should be taken for prompt removal.

In addition to the above, provision should be made for an inspection each morning of the alarm system and of all signaling devices; report thereof to be made to the chief of fire drill.

Drill Exercise—Fire drills should be held weekly without notice, at different hours, and should include all employees in the building. It is advisable that the alarms announcing the drills for each trial should originate on different floors, to afford practice in changing the order of precedence for possession of stairways or fire escapes; excepting that drill evolutions may be so arranged to take advantage of the additional time required in the descent of those from the upper floors, by dismissing such of the lower floors as would not delay the egress of the former.

A further exception to the rule should be made where buildings are divided by fire walls having protected openings, which would allow the transfer of all the occupants on a given floor in the fire

section to an adjoining section on the same floor, or where provision is made for ascending to roof exits that may lead to a safe retreat, either on or in an adjoining building.

Drill Practice—This should closely approximate military precision. All drill movements should lead in the direction of the exits and follow in response to gong strokes.

The first alarm should consist of a series of strokes on a large gong (once repeated), indicating the floor from which the alarm is given. Upon the first stroke of this alarm all operatives should immediately cease work, rise and as far as possible shut off the power to machines. Thereafter each succeeding movement should be announced by single strokes on the smaller drill gongs, sounded by the floor chief or room captain.

Upon the first stroke of the drill gong each operative should remove the stock, chairs or benches nearest him in the aisles, placing them either under or on top of the work table or machine. Before the sounding of the second stroke all aisles and passageways should be cleared of obstructions and operatives ready for line formation, which should be announced by the second stroke. Line formation shall consist of files of two, using a free hand to raise the skirt, in case of women employees, to prevent tripping those in the immediate rear.

The third stroke should be the signal to march to the door of exit passage, and each file should move forward, observing a uniform distance to prevent touching. The line should halt at the doorway on an arm motion signal of either the floor chief or room captain, otherwise continue to the stairway and descend, being subject only to the signals of the stairway guards.

Drill exercises should aim to bring into practice as often as possible all of the signals mentioned, to insure against possible misunderstanding at a critical time.

Upon reaching the street the line should be led away to a safe distance to prevent crowding and confusion around the exit, and for this purpose one of the room chiefs or drill supervisors from the first or nearest street floor should be assigned to the duty of leading the line away from the building.

It is urged, as often as conditions will permit, that all employees at the close of business be dismissed through the drill exits.

Slide Rule for Cutting Pressures

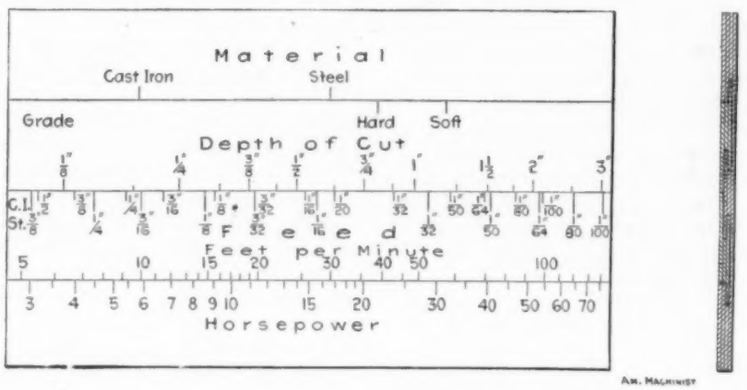
By A. M. O'Brien

The interest aroused by Herbert Seward's charts of the pressure required to cut metals, in Vol. 35, pages 933-934, of American Machinist, suggested the idea of carrying the problem farther, introducing feet per minute and getting the result in horsepower. With this object in view the small slide rule shown was made to cover work in both cast iron and steel and the following description will show how easily a convenient pocket rule can be made.

The construction of the rule is shown in the section; the two inner slides are movable and the outer sections are fast to the body of the rule, and all are made of strips from 3x5-in. cards, such as are used in a filing cabinet, cut and glued together, making a convenient size for the vest pocket. Of course, the small size of the rule makes absolute accuracy impossible and it is only intended for a rough estimation of horsepowers.

The graduations on "Material and Grade" slides are located so as to allow for the addition of other materials or temporary marks for special work. For "depth of cut," only one set of graduations is used for cast iron and steel, as the difference between *D* and $D^{\frac{1}{16}}$ in F. W. Taylor's formulas for cutting cast iron and steel is so slight that it is practically invisible at this small scale, but for the feed it is necessary to have two sets of graduations to allow for the difference between $F^{\frac{1}{16}}$ and $F^{\frac{1}{4}}$ for cast iron and steel in the same formulas.

The whole rule was laid out first for cast iron, the graduations on the horsepower slide being located by working out two or three horsepowers and laying out the rest by the logarithmic scale; the steel graduations on the "material" and "feed" slides were then located to conform to the rest of the rule, two or three feeds being worked out and the rest located by the logarithmic scale.



A Convenient Pocket Slide Rule That Gives Horsepower Pressure When Cutting Cast Iron and Steel

Example Worked Out

To illustrate the way in which the rule is used, suppose it is desired to estimate the horsepower required to take a cut 1 in. deep with $\frac{1}{16}$-in. feed in hard cast iron at a speed of 80 ft. per minute: Set "hard" on upper movable slide opposite "cast iron," move lower slide till $\frac{1}{8}$ mark for feed in cast iron is opposite 1-in. "depth of cut" and read at bottom of rule 35 hp. at 80 ft. per minute.

For a $\frac{3}{4}$-in. cut in ordinary machine steel with $\frac{3}{16}$-in. feed at 40 ft. per minute, set "soft" opposite "steel" and using the lower row of feed graduations set $\frac{3}{16}$ feed opposite $\frac{3}{4}$ depth of cut and read horsepower as before, about 41 hp. at 40 ft. per minute.

These results are horsepower at the point of the cutting tool. Electrical and frictional losses must be taken into consideration in estimating the horsepower required to drive any machine tool taking corresponding cuts.

Decimal Equivalents for $^1/_{128}$ In.

By J. H. Cheetham

I have added on the side of an American Machinist table of fractional inch equivalents in decimals and millimeters, a table of equivalents in decimals for $\frac{1}{2}$ of a 64th or $^1/_{128}$.

It is often necessary in the design of all brass-casting work to keep very close in rough dimensions; i.e., inside or outside diameters in rough are frequently given in 64ths. This, in some cases, gives the thickness of walls in $\frac{1}{2}$ of a 64th ($^1/_{128}$) whose diameter, if given, is in decimals. These have to be figured every time, as no handbooks give decimal equivalents of an inch as fine as $^1/_{128}$, at least I have failed to find them.

This table is also very convenient when answers to examples come in decimals, and it is required to give figures in fractions. For example: Assume that your answer is 0.7231. Even if one knows or reads from a table that the fraction above is $^{47}/_{64}$ in., or below is $^{93}/_{128}$ in., and the answer required is to be in nearest 64ths, he does not know without figuring which is nearest.

History of the First Milling Machine

By Joseph W. Roe

A brief history of the Whitney miller, which is believed to be the first one ever made.

In the same gun shop in which it was built were first developed the fundamental principles of the American interchangeable system of manufacture.

Two other old machines made in this shop, another miller and a gun-barrel reamer, are still in use by the Winchester Repeating Arms Co.

The new edition of the "Encyclopedia Britannica" states that "the first very crude milling machine was made in 1818 at a gun factory in Connecticut."

Eli Whitney, after the invention of the cotton gin, began the manufacture of guns at Whitneyville, just outside of New Haven, in 1789, and by 1815 had "the largest and best equipped private armory in the United States," a shop which had a great influence on the whole trend of American industrial life, as in it were first developed the fundamental principles of the interchangeable system of manufacture.

Believing that this old Whitney shop could be the only one referred to, the present Eli Whitney was asked about it. He said that it was true, at least that there was a little, old machine, which, from his boyhood, was pointed out as having been built by his grandfather, and as the first miller ever built. He believed it was still in existence, and he would try to locate it. It was running for many years in the old Whitneyville shop and was finally set aside as worn out. When the plant was sold to the Winchester Repeating Arms Co., it was about to be thrown out as scrap, but knowing its age and history, he saved it and had it stored in the corner of the barn of the New Haven Water Company.

For 25 years it had gathered dust there at the bottom of a haymow. Mr. Whitney had it dug out a short time ago, and now through his kindness, it is in the Mason Mechanical Engineering Laboratory, at Yale, where it will be preserved in honor.

Front and back views are presented in Figs. 1 and 2, respectively. It stands about 18 in. high and is about 2 ft. 6 in. square over-all. The base is a solid wooden block, carried on short, light, wrought-iron legs. The main spindle, about 2½ in. in diameter, was driven by a single pulley, which must have been about 20 in. in diameter, as the wooden base was gouged out a little to clear it. The spindle ran in solid soft-metal bearings in two flat housings, bolted to the square box-like frame.

The connection between these uprights and the frame is so rough that it does not seem, even allowing for 90 years of rust, to have ever been a machine fit. On the inner end of the rear bearing is a wrought-iron plate, which engages in a groove on the spindle which controlled its position lengthwise.

Both the main bearings are badly worn, as the spindle has a side play of more than $\frac{1}{16}$ in. The slide, jaws and gib-bolts are lost. The slide ran between a gibbed bracket, cast on the frame, and one of the V's on the front bearing support.

The feed was taken from the double-grooved wooden pulley between the spindle bearings down to the lower shaft by a round belt, the return side of which ran

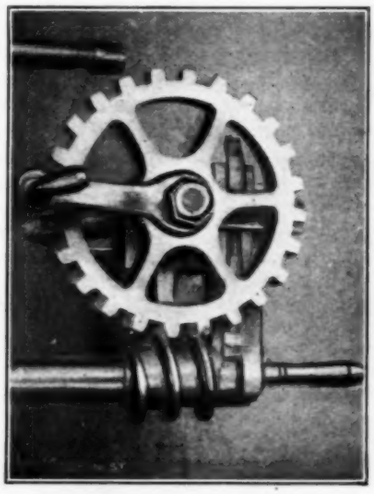


FIG. 3. LATCH IN FOR POWER FEED

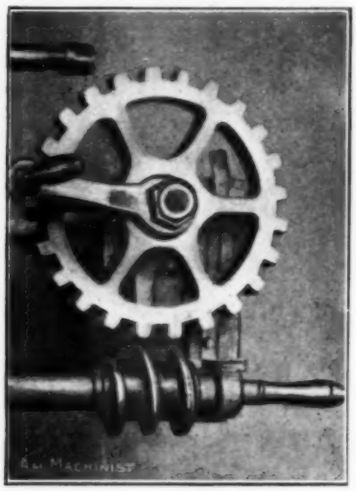


FIG. 4. LATCH OUT FOR HAND FEED

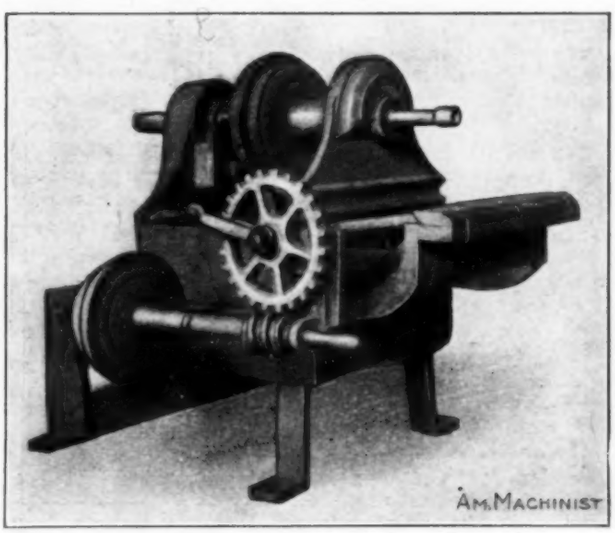


FIG. 1. FRONT VIEW OF FIRST MILLER

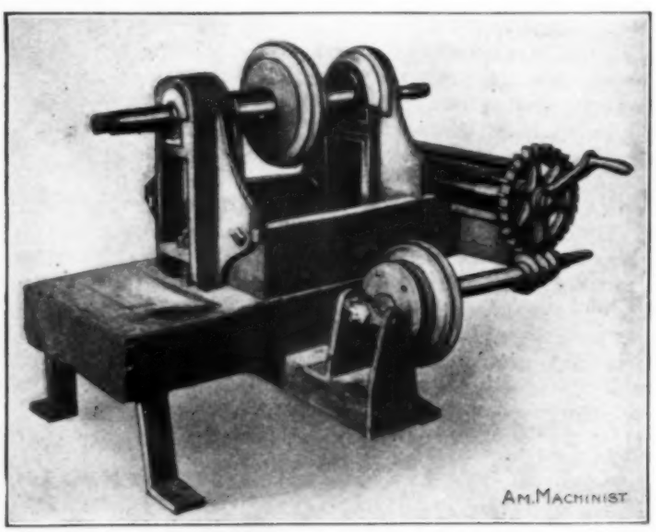


FIG. 2. REAR VIEW OF FIRST MILLER

up through a hole in the wooden base, which is almost hidden by the rear feed-shaft bearing in Fig. 2. A wooden arm, two wrought-iron plates and a swinging bearing carried the rear end of the worm-shaft, the front end of which could be raised and lowered.

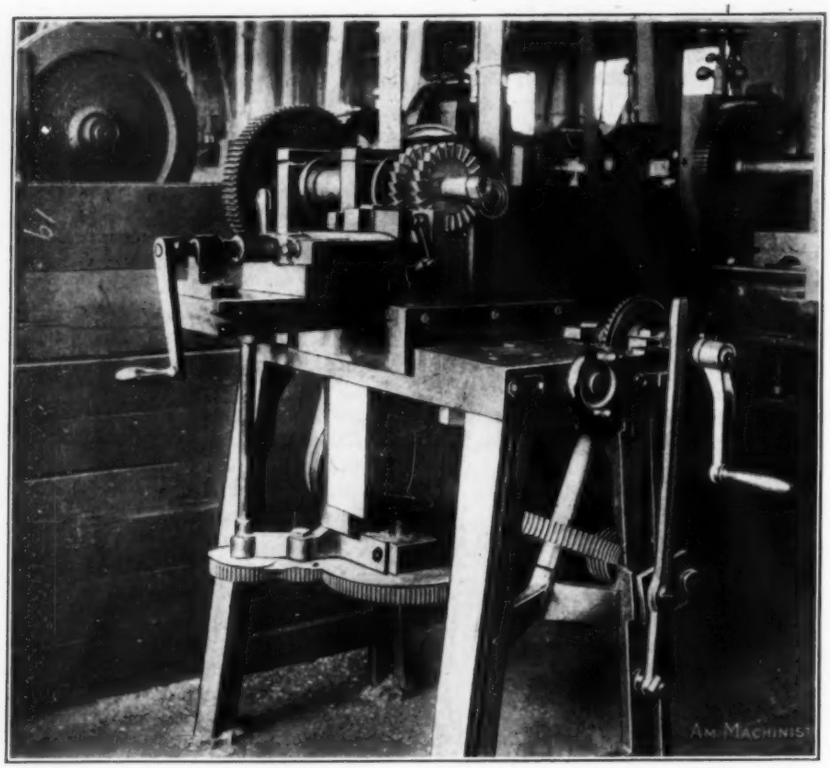


FIG. 5. OLD WHITNEY MILLER AT WINCHESTER SHOPS

The short bearing between the handle and the worm was carried on a small, vertical slide, which has a spring latch to hold it in engaged position. By dropping the latch, the worm on the feed-shaft was disengaged to allow hand feeding.

The feed screw was fairly well cut with what was originally a square thread, but along the middle, under the cutter, it has been worn to a sharp V. The keyways are rough-chipped, and some, at least, of the bolts appear to have been hand-made. Both the main and feed spindles are decorated with beauty grooves like a chain leg. A glance at the wormwheel, Figs. 3 and 4, shows that it was made before the days of involute teeth. It is made of wrought iron and the worm is brass. The front bearing of the wormshaft shows fully one-eighth of wear. It is a quaint little piece of mechanism, but the smile it provokes usually dies away in very genuine respect.

A comparison of the illustrations with that of the old miller at Gay, Silver & Co.'s shop, in Vol. 31, Part II, page 558, seems to indicate that the design of that machine was influenced by this, as the general arrangement of the feed mechanism is very similar. There can be little doubt that this machine is much the older, as it is much more primitive, and, furthermore, the Gay, Silver & Co.'s shop started not earlier than 1835.

The old machines, also from the Whitneyville shop, which are doing work today, are shown in Figs. 5 and 6. They were taken over about 1888 by the Winchester Repeating Arms Co. at the time it purchased the plant, and are still used for rough, light work. The miller in Fig. 5 is very old, no one today knows how old. Some of its gearing may have been renewed, but its main features remain unchanged. The feed mechanism is interesting and shows a great advance from the time of the first machine. Comparison with the driving head of the Lincoln miller at the right shows that already the type had begun to take form.

The other machine, shown in Fig. 6, is a barrel reamer, which is older than the miller seen in Fig. 5. Samuel R. Avis, who worked with it many years ago, says that it must be at least 80 years old. It was venerable even when he first knew it. For the work it is used on, it is a good machine yet.

It has been suggested by an Exchange that the standard practice, particularly in the case of wear limits, be placed in clear language on the blueprint of the part affected, so that this information would be available to the workman. This is an excellent suggestion, and while men who are steadily engaged on the same job generally carry such information in their heads, there is no reason why it should not be on the blueprint and thus avoid the danger of any misunderstanding or mistake. It would relieve the foreman of considerable trouble in many cases, and would frequently prevent useless machine work. This practice should be quite generally applicable.

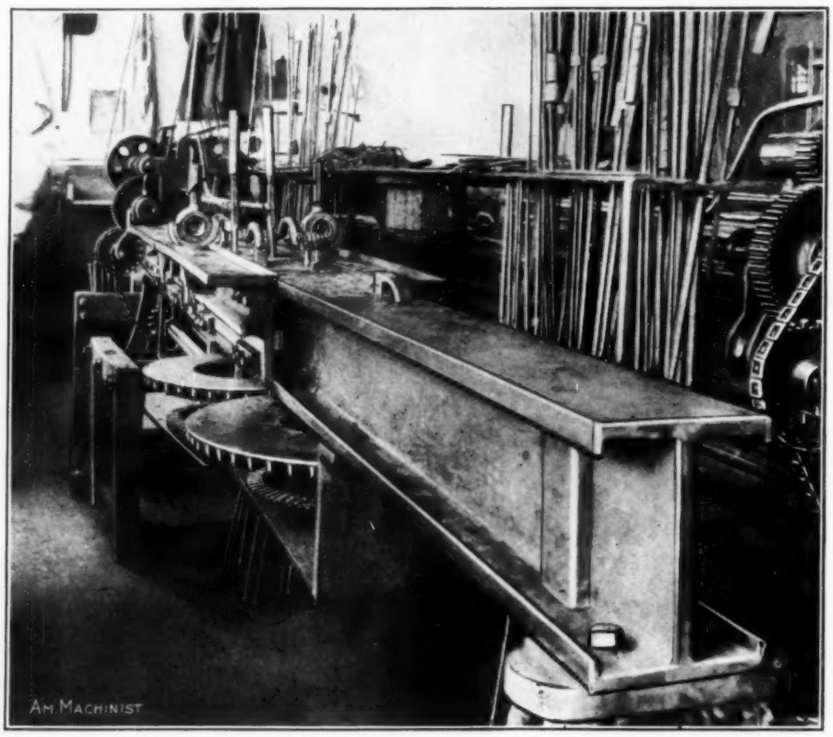


FIG. 6. OLD BARREL REAMER AT WINCHESTER SHOPS, SUPPOSED TO BE 80 YEARS OLD

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Correct Alignment Tools

Apropos of the discussion about limiting machines to a small range of work, it should not be amiss to introduce at this time a few observations on tooling chucking machines, and to show how some tools for interchangeable manufacture are made to obtain correct alignment, and produce accurate work.

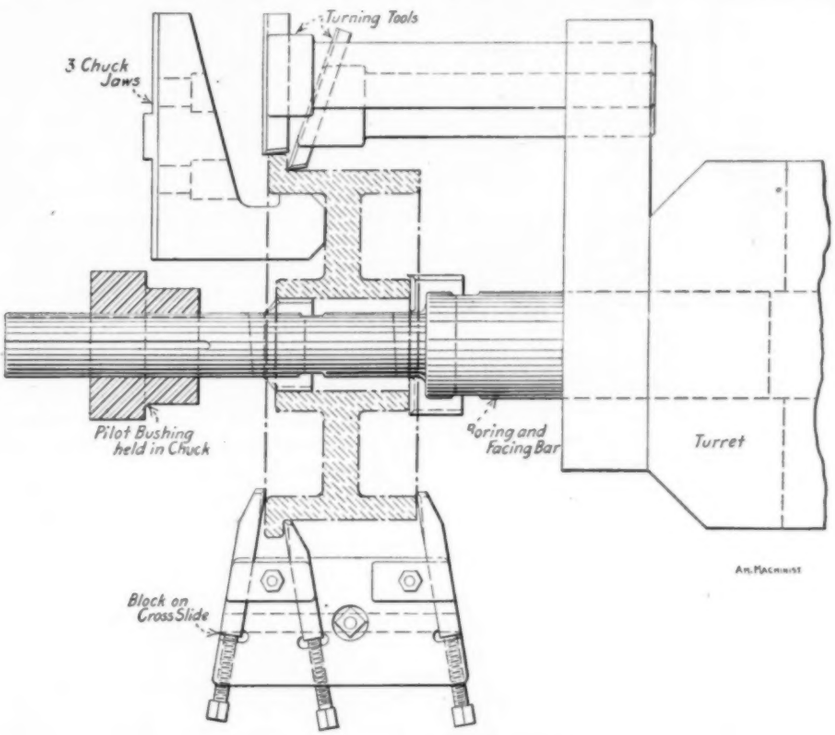


FIG. 1. PULLEY BEING MACHINED

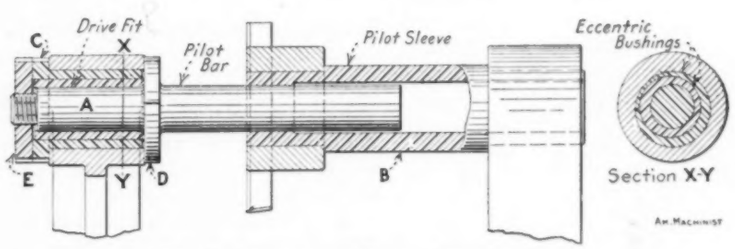


FIG. 3. ADJUSTABLE PILOT ARRANGEMENT

A pulley being machined, both inside and out, at one setting, is shown in Fig. 1. The pulley is held in a scroll chuck, while the tools are held on the turret. As there is sure to be more or less lost motion, owing to the wear of the spindle and the turret slide (which causes chattering), it is customary to pilot the turret tools in a suitable bushing, held in the chuck or headstock spindle, by means of a pilot or boring bar.

This is considered good practice whenever possible, as it also acts as a brace, holding the turret very rigid with the headstock. Furthermore, tools designed for one machine can be used on any machine of similar construction, and the work will be produced in duplicate, as the turret holes are invariably lined up with the hole in the spindle.

The method shown in Fig. 1 holds good whenever practicable. It often happens, however, that there is no hole through the work. In this case, a piloting arrangement similar to the one shown in Fig. 2 is used, and it is a good substitute when the tools can be put on one machine and left there, in which case the hole *A* is bored with a tool held on the turret, which insures correct alignment.

But when we tackle the machine that is used on a variety of work, and the tools are apt to be put on any one of a dozen machines, with the subsequent variations in the height of the center of the spindle from the bed, it would not be profitable to have the bracket *A*, Fig. 2, bored out for each machine. It is to overcome this difficulty and make the tools interchangeable that the eccentric

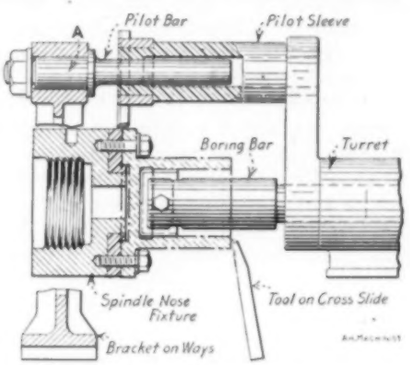


FIG. 2. COVER BEING MACHINED

bushing arrangement, shown in Fig. 3, was designed.

This arrangement consists of two eccentric bushings, by means of which the pilot bar *A* can be brought in line with the pilot sleeve *B* on any machine. By turning one eccentric bushing *C*, the pilot bar is raised or lowered, and by turning the other *D*, it is moved to the right or left, and the whole arrangement is then securely locked by the nut *E*.

FRANK H. MAYOH.

Pawtucket, R. I.

Designating Sizes of Machines

Nearly all builders of machinery agree as to the amount of confusion caused by the use of arbitrary numbers in the case of wire gages and machine-screw sizes, and various and more or less successful attempts have been made to do away with them. Perhaps the most notable example of success in this case is that of the Westinghouse Electric & Manufacturing Co. This company has abandoned wire-gage sizes and designates wire entirely by its diameter in thousandths of an inch.

There seems also to be an opportunity for improvement in the case of machine tools and possibly machinery of nearly all kinds.

The planer has long been an example of rational designation as to capacity, although in many cases we are left to assume that the capacity as to height and width is the same. A 36-in.x12-ft. planer is supposed to handle a piece 36 in. wide and 36 in. high by 12 ft. long. As the height is not always the same as the width, especially in the case of widened planers and those for special purposes, it would be safer to give all three dimensions as 36x36-in.x12 ft., or 144 in., as may be determined.

The size of a lathe as usually given means very little to the would-be purchaser, even assuming that the swing over the bed is within an inch of the nominal size given. Would it not be more intelligible to say 20x16x48 in., meaning a swing of 20 in. over the shears or ways, 16 in. over the carriage and 48 in. between centers? In the case of a rise-and-fall rest, a third diameter dimension might be necessary, but this would involve no confusion as the last figure would always be the maximum length which could be handled between centers. A designation of this kind would show a consumer at a glance the maximum capacity of the lathe under consideration.

While miller manufacturers have done much to standardize machine capacities, these machines are nearly all designated by an arbitrary number in the same way as wire and machine-screw gages. Would it not simplify matters, in this and many other cases, if all machines could be designated by their maximum capacities, as these are among the first considerations with a prospective purchaser?

New York. JOHN R. GODFREY.

An Electric Brazing Fixture

Many times the failure of parts in adding machines, typewriters, etc., may be traced to faulty assembling by such operations as soldering and riveting. Such was the case with the part shown in Fig. 1, which comprises two pieces, a punching *A*, and a lever *B*, to which the first piece was riveted; after riveting, the joint was soldered.

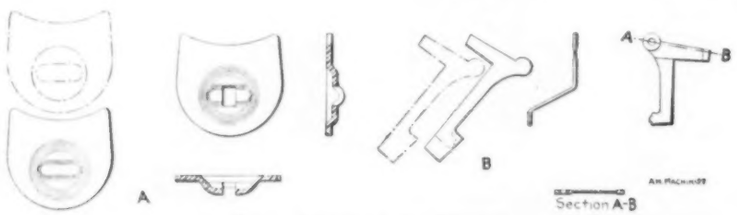


FIG. 1. PARTS TO BE BRAZED

The part shown is the key lever and finger key for a small portable typewriter, and as such has to stand hard usage. The joints, made in the manner described, were usually all right, but occasionally an imperfect one escaped inspection and was placed in the machine. Brazing was resorted to and proved to be the proper thing as it gave a stronger joint. However, it was not fast enough or clean enough, so the fixture shown in Fig. 2, for brazing by using electric current from a low-voltage dynamo, was designed.

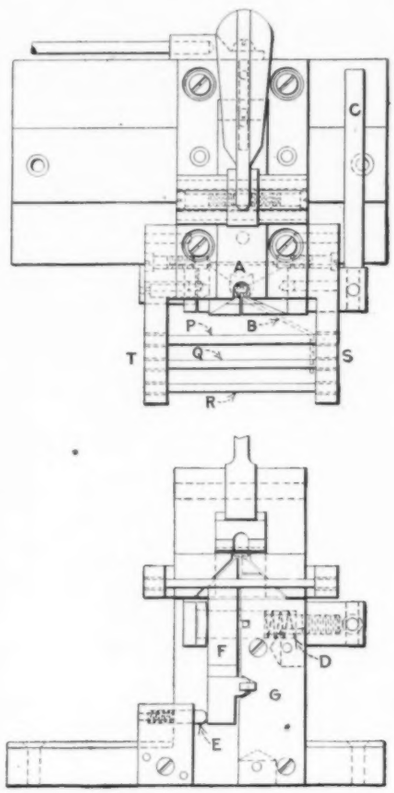
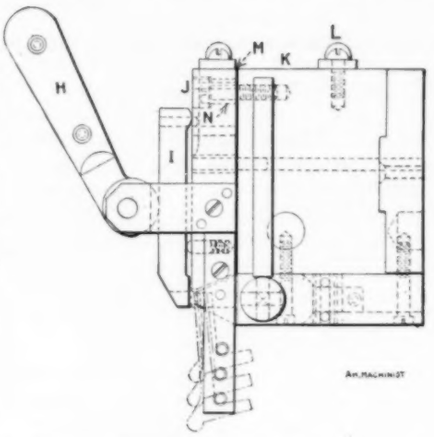


FIG. 2. THE FIXTURE USED FOR BRAZING

This fixture locates the pieces *A* and *B* correctly, as shown, and holds them while the current heats the section around their points of contact, as shown at *O*, Fig. 3. Borax and spelter are placed in the cup shape of *A*, which immediately melts when *A* and *B* become red hot at the point *O*. The spelter runs very nice and clean, making the job appear brass-plated.

The operation of the fixture is as follows: The handle *C*, Fig. 2, is drawn to the front, causing the spring *D* and the spring plunger *E* to open the jaw *F*, which is both an electrical connection and locating means for the part *A*, dropped in between the jaws *F* and *G*. The lever *C* is then thrown to the back and the piece *B* is located. The lever *H* is pushed to the front, and the sliding bar *I* pushed back. The part *A* is placed over the projecting teat on *B*, as shown in Fig. 3, then the bar *I* is pushed forward and the lever *H* pushed back; this forces *A* and *B* to the correct position and also forms the other electrical connection through *J*.



The piece *A* is pressed between the surfaces *I* and *J*, which are insulated from any part of the fixture in contact with the part *B*. A wire ⅜ in. in diameter is connected with *J* and another of the same size is connected with the base *K* at *L*. The base is insulated from the parts *H*, *I* and *J*, but the base *K* makes connection with the parts *F* and *D*. The part *J* is insulated from the base *K* by the sheet fiber *M*, fiber bushings *N*, around the connecting screws and the fiber washers *W* under the screw heads as shown in Fig. 4.

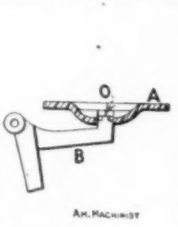


FIG. 3. CONNECTING THE PARTS

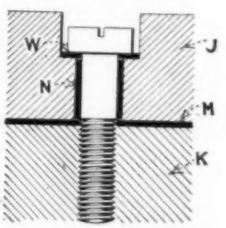


FIG. 4. METHOD OF INSULATION

After the parts to be brazed have been properly located and clamped as shown, connection is made by means of a knife-blade switch, with a dynamo of from 4 to 10 volts. The projecting teat *O*, Fig. 3, on the piece *B* and the part of the piece *A* around the teat *O*, instantly become red hot, so that the little grains of spelter and flux immediately melt and braze the joint.

The switch must be handled very quickly, allowing it to be closed but an instant, or else the current will burn up the piece. By having the current stronger

than required to heat the piece, an astonishingly large number of pieces can be finished in a day.

The rods *P*, *Q* and *R* are to accommodate the varying offset pieces *B*, and are insulated by bushings of fiber from the pieces *T* and *S*.

After the pieces are brazed, only a slight indication of their having been heated is shown, and that is confined to a small area of the cup shape around *O*, Fig. 3. After a few minutes in the pickle bath, the small amount of clinging borax is removed and the job appears to be a piece of fine soldering, only it is the spelter that shows. All the electrical connecting pieces in the fixture are made of copper.

Dayton, Ohio. D. A. CORMER.

Combination Die and Tap

On screw-machine work I have often had jobs that required one more operation than there were stations in the turret; the case usually was such that a tap and die of the same lead could be placed in one station and the tapping and threading completed at one operation. This is very simple, but when a case comes up like the above with the tap and die of different lead; for instance, the die having to have 36 threads per inch and the tap 32 threads, or *vice versa*, the job assumes a different aspect. To meet the difficulty, I have designed two styles of combination die and tap.

The first one is for a case where the tap has more threads per inch than the die, the tap feeding in at a faster rate than the die. The construction is quite obvious. The die is seen at *B*, Fig. 1, *C* is the sleeve fitting in the die and held fast by the setscrew in which there is a channel slot in which the pin *D*, running through the tap *A*, slides, keeping the tap in place and also from revolving with the work; the spring *E* pushes the tap back to its place when not performing any work.

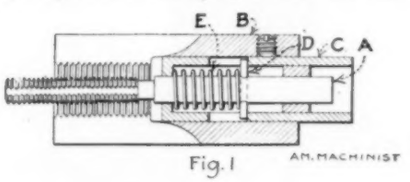


Fig. 1

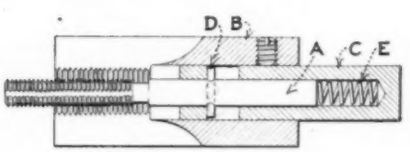


Fig. 2

COMBINATION DIE AND TAP

The second style of combination die and tap is for a case where the die has more threads than the tap, the die feeding in at a faster rate than the tap. The construction here is also quite simple. The die is shown at *B*, Fig. 2, *C* is the sleeve fastened as before, in which there is a channel slot in which the pin *D*, running through the tap *A*, slides, keeping the tap in place and also from revolving with the work, the spring *E* tends to keep the tap forward when not in use.

CHARLES WOLF.

Philadelphia, Penn.

Semi-Automatic Attachment for Disk Grinder

We had several thousand collars to make similar to the one marked *H* in the illustration. These were made of cast iron and were used in connection with some ferro-concrete construction work. The hole was first drilled and the small boss faced on a vertical drilling machine. The bottom face had to be fairly flat.

They were cast as near as possible, and as it would not have paid to machine each one in a lathe, we decided to "disk grind" this bottom face. The attachment, shown was therefore rigged up, the idea being that a boy could operate it by simply keeping it supplied with castings and removing them when finished.

The disk *A* is fitted with four pins for carrying the castings, these being spaced 90 deg. apart. It is carried on the long hub of the wormwheel *F*, which revolves the disk through two keys. At the same time, the disk is free to slide longitudinally, the thrust being equalized by the two keys. The spring *D* puts end pressure on the work-holding disk, forcing the work against the emery disk while the former is slowly revolving past the fast-running grinding disk. The amount of pressure can be varied by adjusting the collar *E*, this pressure being increased as the disks get duller through wear.

The shaft *B* is fixed in the body of the machine and carries at its outer end a bracket which in turn supports the wormshaft, and pulleys. This bracket is fixed by means of a pin fitted through the boss and the shaft. The fast and loose pulleys run at 100 r.p.m. and as the worm and wormwheel have a 50 to 1 ratio, the disk revolves at two revolutions per minute.

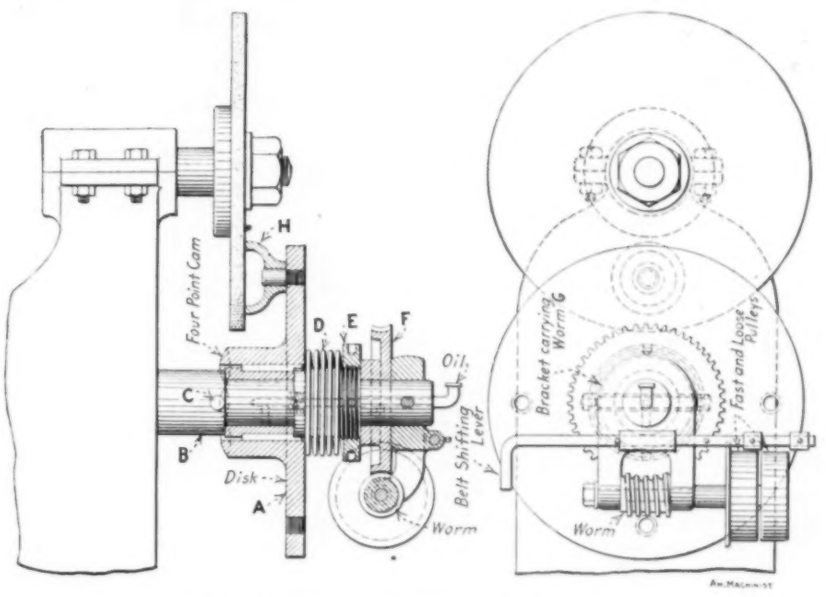
To allow for variations in the width of the castings, the disk is given a longitudinal reciprocating motion, this being obtained by shaping the edge of the boss on the disk into a cam with four high points. A hardened-steel pin *C* is fitted through the shaft projecting equally on each side, so as to get a bearing on the cam on both sides, thus avoiding any tendency of the disk to stick, or bind, through a one-sided pressure.

When the work just leaves the emery disk after being ground, the high point of the cam comes against the pin, which forces the disk away and withdraws the work from the machine. This allows the next casting to come opposite the disk before the cam permits the disk to slide back bringing it into contact.

If the operator finds that once across the disk is not sufficient to clean up any one particular casting, he leaves that one on for a second grinding. He would, of course, stand in front of the machine, taking off the finished work as it came round and replacing it with the rough castings. The belt-shifting lever is placed handy to stop the attachment from revolving.

With the use of this attachment, a boy can easily accomplish 30 per cent. more work in a given time than a man doing the same job by hand on an ordinary disk grinder.

Birmingham, England. R. DAVIS.



SEMI-AUTOMATIC ATTACHMENT FOR DISK GRINDER

Bar for Cutting Oil Grooves in Loose Pulleys

The bar shown was designed for cutting circular and longitudinal oil grooves in loose pulleys that are being bored in a turret lathe, which has no means of feeding or adjusting a tool in a transverse direction. The work done by this bar is very satisfactory and dispenses with the work and time of resetting the pulleys in another tool to perform these operations, and the longitudinal grooves are cut much easier, as the pilot wheel on the turret lathe has a greater leverage than the handwheel on the engine lathe, on which the work was formerly done.

The rigid bar proper *A* is bored eccentric to receive the rotating bar *B*, and slotted diametrically opposite to receive the arm *C*, as shown in the assembled view. This rigid bar was made of 1⅛-in. cold-rolled steel, 16 in. long, including ⅞ in. extra lengths left on the bored end to be cut off after turning and boring. The stock was centered on both ends for both the turning and boring operations. The turning to fit the turret on the one end and to freely enter the pulley on the opposite end was first done, leaving the ⅞ in. extra length the full size of the stock; it was then placed on the other center and the extra length was turned to the largest diameter that it would true up to.

The chuck jaws were then set onto it (without taking it off the centers) to hold and drive it for the boring operations. The steady rest was next set to the last turned part on the extreme end, the tail center removed, and the hole bored for the rotating bar, after which the extra length was cut off.

The rotating bar *B* carries the tool *D* for cutting the circular grooves, and is also provided with a cam just outside of the rigid bar *A* to operate the arm *C*, which is pivoted on the pin *E*, held against the cam by the spring *F* and which carries the cutting tool *G* for cutting the longitudinal grooves. The handle *H* is attached to the rotating bar *B* after passing through the slot shown in the rigid bar *A*, and holds the rotating bar in place and controls its rotation.

This handle is locked in any desired position by the knurled sleeve *J*, which is always in partial engagement with the handle, being kept there by the pin *K*; it can be slid endwise to lock it when any one of the small notches is placed in line with the pin *L*. The assembled view shows the handle in a horizontal position, which places the cutters in a neutral position, but with the sleeve out of engagement with the locking pin *L*, ready to be swung in any position desired.

To use the bar it is locked in the position shown, the bar is passed into the pulley the required distance (the bar is graduated to facilitate in this setting), the sleeve slid out of engagement with the pin *L* and the handle raised slowly from a horizontal to an upright position, or to a height sufficient to cut the groove to the desired depth. The handle is brought back to the neutral position and locked and the operation repeated for each groove cut.

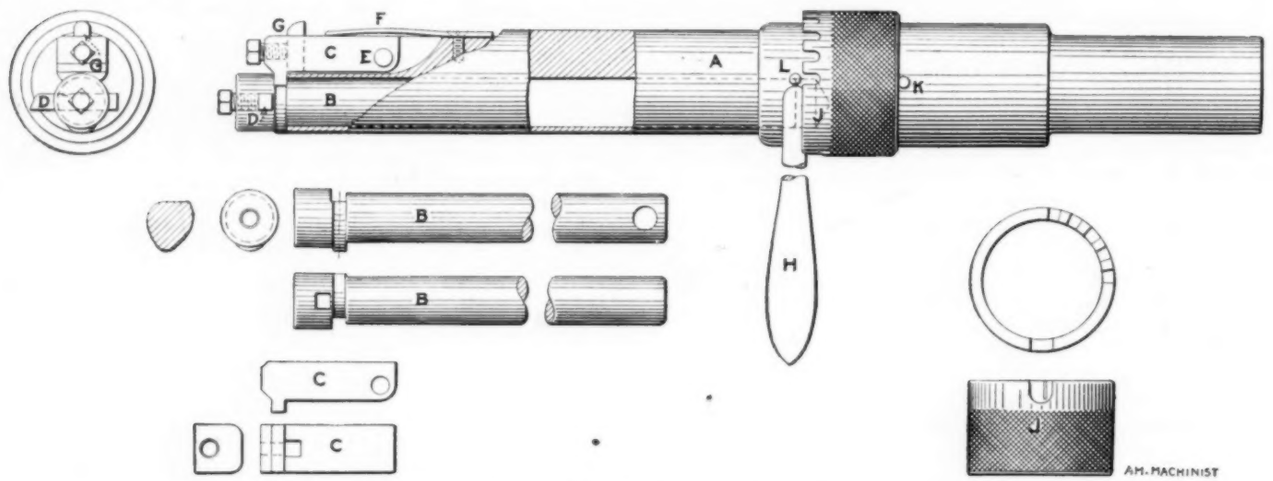
It will be noted that the cam is of such shape that the quarter turn of the handle between the horizontal and upright positions has no effect on the arm.

After the circular grooves are all cut, the lathe is stopped and the bar placed where the cutting tool in the arm *C* will be at the farther end of the desired longitudinal groove, the handle is unlocked and moved downward one or more notches on the sleeve *J*, locked in position and the carriage pulled out by the pilot wheel of the lathe far enough to cut the required length of groove. After this the handle is again locked in the neutral position and the operation repeated, setting the handle a notch deeper each time until it is in a vertical position, pointing downward, or until the required depth of groove is obtained.

There is enough movement given to the cutting tools by the handle to cut the required depth of groove without readjusting the cutters, the cutting tools being set in the proper relation to the bore of the pulley at the start.

MARTIN H. BALL.

Watervliet, N. Y.



BAR FOR CUTTING OIL GROOVES IN LOOSE PULLEYS

Estimating Volume of Bevel Gear Rims

The following is a simple method of finding the cubical contents of the rim of bevel gears. While not theoretically correct, giving a small excess, yet it is sufficiently accurate for all practical purposes.

First make a rough outline of a section of the rim to scale. Then, if it is a cut gear, draw the lines *AB* and *CD* parallel to the cone pitch line *EF*. We then have a rectangle *ABCD*. Next find the center of gravity of this rectangle and scale the distance from the axis of the gear to this center of gravity. This distance will be the radius of a circle passing through the center of gravity of all right sections of the rim. Then the volume is equal to $2A\pi R$, in which *A* is the area of the section and *R* is the distance of the center of gravity of the section from the center line of the gear.

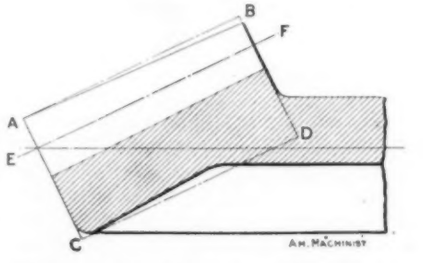


DIAGRAM FOR ESTIMATING VOLUME OF BEVEL-GEAR RIMS

For a cast tooth gear draw the line *C D* parallel to the cone pitch line *EF*, find the center of gravity of the rectangle *CDEF* and proceed the same as for a cut gear.

AUGUST H. ANGER.

McKees Rocks, Penn.

A Radial Milling Fixture

The radial milling fixture shown in the illustration may prove interesting to readers of the AMERICAN MACHINIST.

We had an order for a large number of steel forgings to be milled radial, as shown at *X*, and, after considering several methods, decided to make a fixture for use on a Brown & Sharpe miller, as shown.

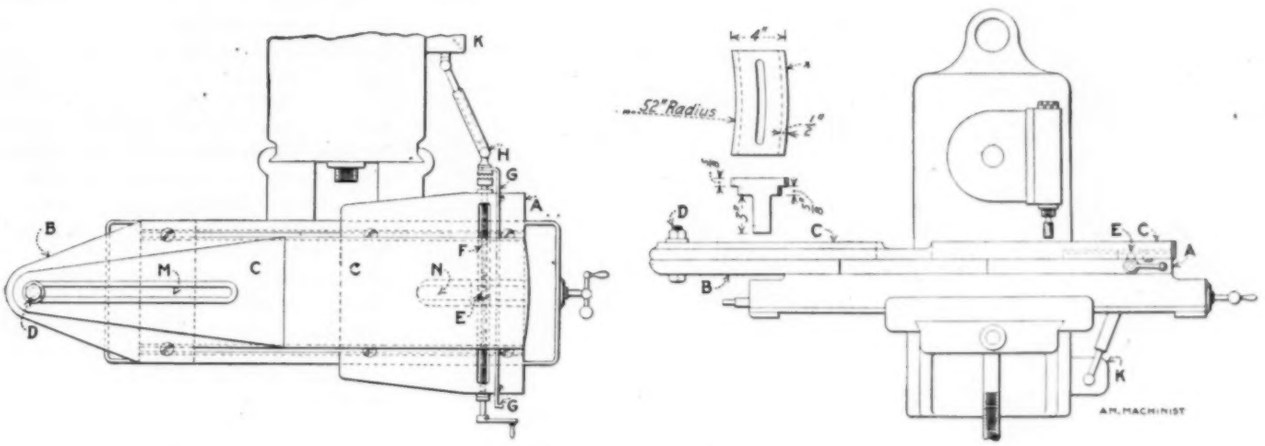
After the first piece was milled, a swinging finger gage was made to just touch the inside edge of the work, then all the other pieces were milled to this gage, thus securing interchangeability.

This device was used not only on the work shown, but also on a number of similar jobs. It has given entire satisfaction, and can be taken off very easily when the miller is wanted for use on other work.

Washington, D. C. V. E. TRASK.

A Beer-Keg Tumbler

Undoubtedly beer kegs have made many a "tumbler" in the past, but I have never seen another beer keg put to so useful a purpose as the one which is doing duty in a Jefferson St., Chicago, shop in the manner illustrated.



A RADIAL MILLING FIXTURE

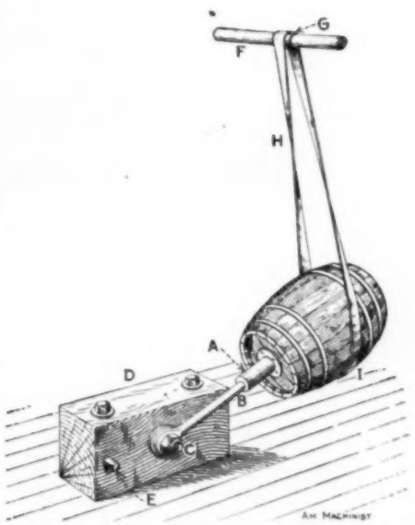
A cast-iron plate *A* was bolted to the right end of the miller table, and a pivot plate *B* was bolted to the left end, as shown.

The plate *B* has a slot milled across it to receive the feed screw *F* and the pivot block *E;* the feed screw has the clutch *H* fitted on the back and may be thrown in or out by the feed rod *G*. The clutch *H* is connected with the change-feed box *K* by the telescoping rod and the two knuckle joints.

Swinging on top of plates *A* and *B* is the radial platen *C*, which is pivoted at *D*, and is adjustable for different radii by slipping the pivot along the slot *M*. The platen *C* has a T-slot milled at *N* to receive the pivoting block *E*, which is fed along by the feed screw *F*, thus giving the platen *C* a circular motion. It is also prevented from lifting by the block *E*.

T-slots were milled in the platen *C* for convenience in clamping down the work, which was held in a special holding block, and located the proper distance from the pivot *D* by careful tramming. An extension block was placed behind the vertical head to bring the spindle over the center line of the radial table *C*.

A flange *A* is bolted to the head of the keg and continued into a sleeve bored to fit the short shaft *B*. The shaft is flattened at the lower end and a hole punched through it to receive the lagscrew *C*, which, with a large washer, serves to fasten the shaft *B* to the block *D*, which in turn is bolted securely to the floor of the shop. The block is located nearly underneath a shaft from which power is taken, and a bit of insulating (friction) tape is wound upon the shaft *F*, at *G*, to act as a pulley for the belt *H*. The slight enlargement of the shaft by the tape answers admirably for pulley purposes.



A BEER-KEG TUMBLER

To set up this device, a belt is procured, which, when passed around the bilge of the barrel as shown at *I*, and also passed around the shaft, sustains the keg in about the right position for tumbling. The keg is placed inside the belt and the block moved forward and back, crosswise of the shaft, until the belt *H* tracks fairly upon the keg. Then the block *D* is fastened securely to the floor.

If preferred, the position of the block *D* may easily be determined by calculation, and the block laid down in the right spot to cause the keg to run with the shaft *B*, at any desired angle. By lengthening or shortening the belt *H* the angle of the keg or of its axis may be changed from about 30 deg., as shown, to nearly 60 deg. without altering the position of the block *D*. The "crown" of the "keg pulley" is so great that the belt will run fair through the range of 30 deg. in the angularity of the shaft *B*.

When it is desired to empty the keg, it is simply lifted from the belt, which is brushed one side, along the shaft *F*. Then the keg may be either lowered to the floor, or raised and swung backward until the shaft *B* comes into contact with the stop *E* in the far end of the block. This permits the keg to be dumped on the floor underneath where it is shown in the engraving, and then swung over the other side for recharging. The flange and sleeve *A*, being loose upon the shaft, may be slipped off at will and the keg emptied of its contents into a box, or directly upon the bench.

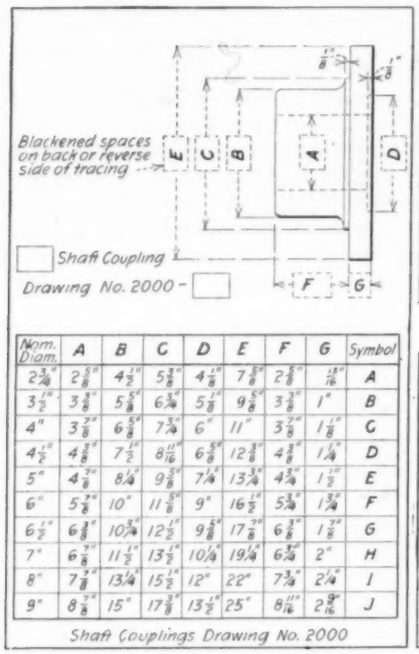
Barberton, Ohio. J. F. HOBART.

Tabulated Shop Drawings

In many instances tables of standard parts are compiled in the drawing office as a means of handy reference; these are sent into the shop in lieu of detail drawings. The disadvantage of this lies in the necessity of workmen referring to a letter on the face of the drawing, then to a table of dimensions to get his sizes. In this also is the chance of error in following across lines and down columns.

As an improvement over this, it is suggested that, instead of sending out blueprints of the entire tracing, the tracing be prepared as shown in Fig. 1. Here the dotted squares around the letters on the drawing or sketch indicate blackened spaces on the reverse side of the tracing. By this means a print is obtained having blank white spaces in place of the letters.

A sample of the blueprint ready for entering the dimensions is shown in Fig. 2. The dimensions can then be filled in on this print by a detailer, taking the proper figures from the tracing. The completed print is shown in Fig. 3. Any further information can be entered, such as shop order numbers, etc. The column at the extreme right is suggested as a sub-index, to be entered in the space following the drawing number as a means of identifying a copy carrying any particular line of figures. This is also illustrated in Fig. 3, which shows the line *D* to be a 4½-in. coupling.



Nom. Diam.	A	B	C	D	E	F	G	Symbol
2¾"	2⅝"	4½"	5⅜"	4⅛"	7⅞"	2⅝"	1/16"	A
3½"	3⅜"	5⅛"	6¾"	5⅛"	9⅝"	3⅜"	1"	B
4"	3⅞"	6⅝"	7¾"	6"	11"	3⅞"	1⅛"	C
4½"	4⅜"	7½"	8 11/16"	6⅝"	12⅜"	4⅜"	1¼"	D
5"	4⅞"	8¼"	9⅝"	7¼"	13¾"	4¾"	1⅜"	E
6"	5⅞"	10"	11⅝"	9"	16½"	5¾"	1¾"	F
6½"	6⅜"	10¾"	12½"	9⅝"	17⅞"	6⅜"	1⅞"	G
7"	6⅞"	11½"	13½"	10¼"	19¼"	6⅞"	2"	H
8"	7⅞"	13¼"	15½"	12"	22"	7⅜"	2¼"	I
9"	8⅞"	15"	17⅜"	13½"	25"	8 11/16"	2⅝"	J

Shaft Couplings Drawing No. 2000

Fig 1

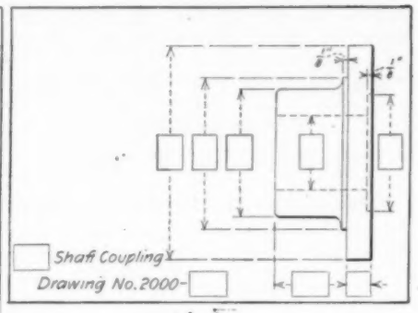


Fig. 2

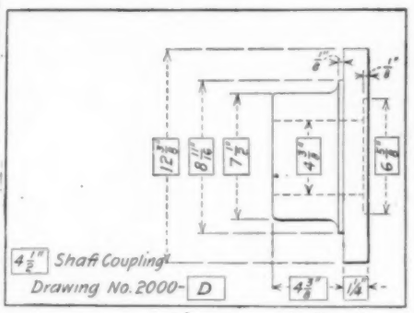


Fig. 3

TABULATED SHOP DRAWINGS

The idea can also be applied to regular working drawings, in which it is desired to make alterations in dimensions. A letter to represent the dimension can be placed adjacent; blackening a space under both on the reverse side of the tracing; and writing in a table showing the necessary figures. In making prints it will then be necessary to fill in the figures in the white spaces. By this method, the original records are preserved intact, while considerable elasticity is gained.

JAMES KAY MCINTYRE.
Newburgh, N. Y.

Squaring the Ends of Automobile Driving Axles

A milling fixture to be used in connection with straddle mills for holding and indexing automobile driving axles while the ends are being squared, is shown in Fig. 1. A gage *X*, which is placed in the fixture when commencing the job is used for locating the fixture central with the straddle mills.

The details of the fixture are shown in Fig. 2, and consist of a clamping end *A* (whose operation is understood without explanation); of a tail-end support *B*; of the fingers *C*, for insuring that the flats on each end are parallel; and two hardened-steel bushings *D*, used in connection with the indexing dog. The operations are described as follows:

After placing the work in the fixture in an approximate position, the index dog is clamped on loosely and the hardened-steel pin *E* is inserted in one of the bushings *D*. The dog is then securely clamped on the work. As soon as the nut *F* is tightened the job is ready for the first operation of milling, after which the nut *F* is slackened and the pin *E* is changed to the other bushing, which is located exactly 90 deg. from the other and on the same radius. After the square is thus milled on one end and the work is reversed, two parallel sides are clamped between the fingers *C*, and the other end is squared as in the previous operation. The varying diameters of the work cause the distance between the work center and

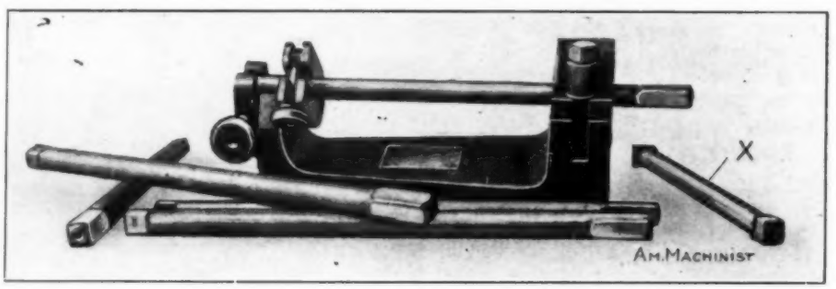


FIG. 1. MILLING FIXTURE FOR SQUARING ENDS OF AUTOMOBILE DRIVING AXLES

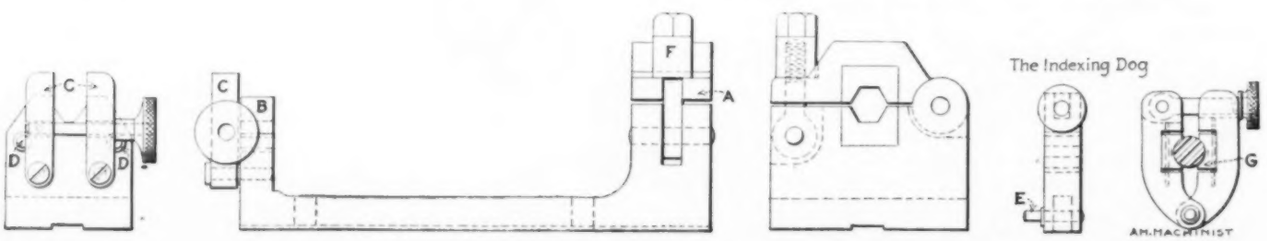


FIG. 2. DETAILS OF FIXTURE FOR SQUARING ENDS OF AUTOMOBILE DRIVING AXLES

the pin *E* to vary so that the sliding jaws *G* are necessary.

With this outfit the time for squaring the driving axle ends has been reduced very materially, beside giving us the use of one more dividing head for other jobs.

Indianapolis, Ind. G. W. LINN.

Large Radius Turning and Feed for the Tail Spindle

The attachment shown in Fig. 1 is placed on a gap lathe for the purpose of turning the segment of a circle of large radius such as is found on blanking dies of pail or tub sections, and other work, within the range of the attachment.

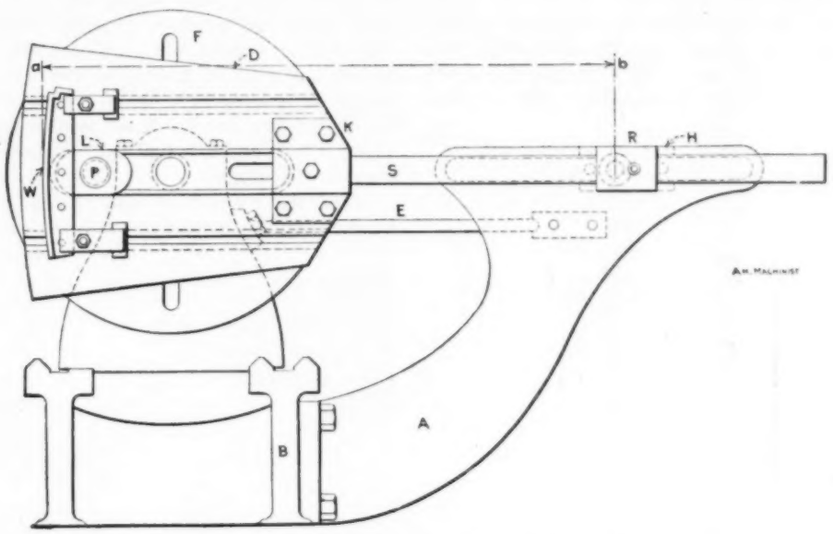


FIG. 1. ARC-TURNING ATTACHMENT

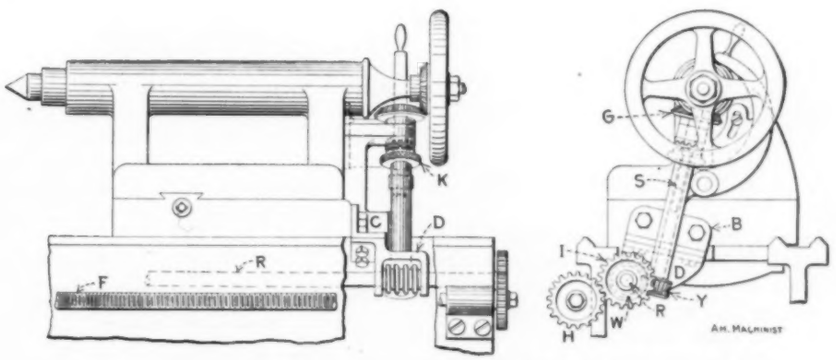


FIG. 2. TAIL-SPINDLE POWER FEED

The large bracket *A* is secured to the bed *B* of the lathe in such a position that the back of the plate *D* rides on the surface of the faceplate *F*. The brace *E* is an additional support for the bracket *A* from the headstock. The plate *D* is kept in contact with faceplate *F* by the pin *P* and the block *L*.

At the rear of the plate *D* is secured a bracket *K* which carries one end of the shaft *S*, the other end passing through the swivel block *R*, which is free to turn in the piece *H*, while it can be secured in the slot, as shown, to suit the radius being turned, as *a b*.

The pin *P* is secured to the faceplate in a position that gives the desired travel to the work *W*, which is fastened to the plate *D*. As the lathe spindle revolves it gives an oscillating motion to the work, similar to the action of a shaper, only the tool is stationary while the work is in motion.

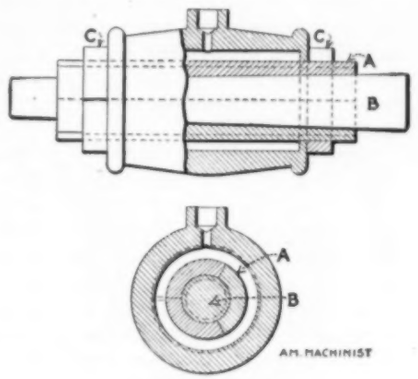
A power feed for drilling on the lathe is shown in Fig. 2. Secured to the end of the feed shaft or lead screw *F* is the gear *H*, which meshes with a similar gear *I* fastened to the auxiliary shaft *R*, which runs along inside the lathe bed just above the web.

On the shaft *R* is the worm *W*, contained within the bracket *D*, which is secured to the bracket *B* fastened to the tailstock with the bolts *C*. The worm *W* meshes with the wormwheel *Y* which drives the shaft *S* and the miter gear *G*. The miter gear *G* is keyed to the tailstock spindle. The knurled nut *K* operates the feed.

Hamilton, Ontario. J. H. RODGERS.

An Efficient Babbitting Mandrel

The cut shows a babbitting arbor which, while rather expensive to make, is very efficient. It consists of a sleeve *A* bored taper and turned cylindrical to size after it is split in three parts. The mandrel *B* fits the taper bore of the special sleeve *A*. Two retaining rings *C*, split at one side, are used to hold the sectional sleeve *A* in place on the mandrel *B*. The split permits a certain amount of spring to the retaining rings *C*.



A BABBITTING MANDREL

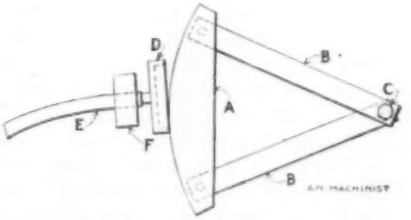
No paper need be used around the sleeve; anything that will take care of the shrinkage of the metal is all that is necessary. The rings *C* prevent the babbitt from running out at the ends if the ends of the boxes are true.

Van Buren, Ark. D. D. RANDOLPH.

Grinding a Curved Die

Not long ago I saw a man grinding a hardened-steel die.

He had mounted the piece *A* to be changed on the radius arms *B* with a center at *C* and was swinging it across a cup wheel *D* driven by the flexible shaft *E*. The wheel was clamped in the proper position in the V-blocks *F* and the feeding was done by tapping these blocks lightly with a hammer.



GRINDING A CURVED DIE

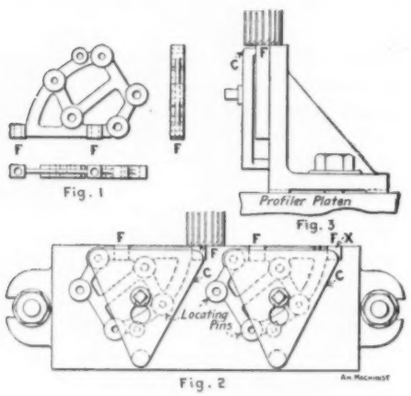
In grinding the concave section to match this, the wheel was mounted on the radius arm and the piece clamped in position on a surface plate.

Philadelphia, Penn. W. ALTON.

Milling Small Castings

We had several thousand of the small cast-iron side frames, shown in Fig. 1, on which to face each side of the bosses and the feet on bearing spots marked *F*. The sides of the frames were finished in the profiling machine, after which the holes were drilled. After the frames were profiled to size and finish, they were located by two pins in a milling jig consisting of a flat cast-iron plate large enough to hold two frames at one setting, as shown in Fig. 2, the work being clamped down by the triangular plates *C*.

Two bolts secured the jig to the miller platen in the usual manner, and an end mill was used to face the feet of the side frames. After a cut had been taken the frame was placed in a test jig to ascertain the proper amount of metal to be removed, the work being moved toward the cutter until the proper test was shown, after which every tenth frame



MILLING SMALL CASTINGS

was tested to assure the whole lot being right.

The work was all right until an operator struck the corner of the jig with a hammer to drive it back about 0.001 in. to properly test again, as one of the frames showed out of true. The hammer bruised the jig at *X*, Fig. 2, in such a way as to cause the side frame to spring when clamped down and spring back after being milled, thus causing the surfaces *F*, Fig. 1, to be out of true. This showed plainly when two of the frames were stood side by side on a surface plate, one of the frames would lean away out of parallel with the other frame.

To avoid further annoyance of having the work go wrong, a small single plate about 5x5x6 in., was milled true and a tested side frame clamped in position on the vertical face, the locating pin holes spotted and the frame removed. The holes were then drilled and reamed, two drill-rod pins driven in and a hole drilled and tapped to receive one of the binding screws out of the old jig.

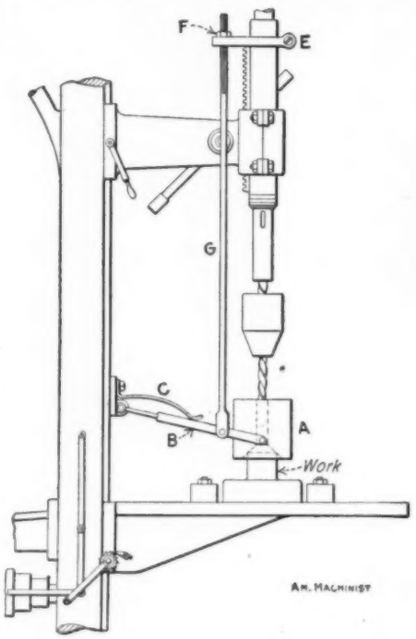
One of the triangular plates *C* was used and we had a jig for the profiler as shown in Fig. 3, with which, by using a roughing and a finishing cutter, we finished the next order of side frames in one-tenth the time it formerly took to do them on the miller. Where the work can be done in a profiler much time can be saved and better results achieved than with a miller.

Maplewood, Mo. GEO. G. LITTLE.

A Rapid Drilling Method

To handle 35,000 small castings as cheaply as possible the device shown herewith was evolved.

The job called for a ⅜-in. hole to be drilled approximately central in a boss cast on the piece. The first move was to lay the piece on a speed-press table and arrange stops which kept it from



A RAPID DRILLING METHOD

turning, but allowed a slight floating action. Then a bushing was made which fitted the drill, and was bored out bell-mouthed on one end to fit over the boss on the work. This bushing is shown at *A*. It is loosely held by a swivel sliding arm *B*, which is pressed down by a stiff spring *C*. The drill is in the bushing at all times. The bushing, pressed down by the spring, keeps the work true while drilling, and after the hole is through and the drill has been raised high enough to clear the work about ¼ in., the collar *E* on the drill-press sleeve strikes the adjusting nut *F* on the threaded rod *G*, raising the bushing clear of the work, which may then be removed and another piece inserted.

The collar *E* may be set so that drilling can be done to a given depth or may be put up out of the way for through holes. The slight vibration set up in the bushing by the drill helps to settle the work into place, and the drilling is very well done.

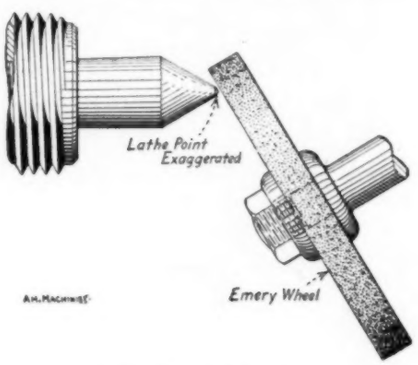
H. W. JOHNSON.

Poughkeepsie, N. Y.

Grinding Centers

If in grinding the points of a lathe, miller, or other centers intended to take centered work, after grinding the 30-deg. angle, the side of the emery wheel is brought up against the point of the center, it will take off the extreme sharp point. Moreover, it will not cut or scratch the hands so easily, will shorten the point slightly, will not bottom in the work center so quickly. Further there will still be a point that will run true; it will not wear a groove in the work center, as it may do if it is ground off flat by holding in the hand against an emery wheel, and it is less likely to break than if left sharp.

When the point is ground off flat by hand it is often not square with the cen-



GRINDING CENTERS

ter line of the center. It is only on rare occasions that the extreme sharp point is necessary. If the point is ground off flat it will often run out of true and may cause the work to do so also, if the centers are not just in line, or when the tailstock is set over.

EDMUND S. WILLIAMS.

Bridgeport, Conn.

At a recent meeting of the American Electrochemical Society, there was presented a paper on the suitability of various heat-insulating materials for checking furnace heat-radiation losses. The materials tested, in the form of bricks, were built into furnaces, heated from the inside by a nichrome resistance wire. The following is the order in which some of the materials tried stand, in order of descending conductivity: Silicon carbide; magnesia; alundum; silica; firebrick; red brick. The above results show why alundum crucibles or muffles should be desirable. The great insulating effect of small quantities of loosely packed coverings was also pointed out.

Measuring Taper Shank Angular Mills

By G. Haessler

By slight modification a regular protractor is made available for measuring any angle required on mills of 1.5 to 1.6 in. in length and 0.3 to 0.5 in. in diameter.

The ideas herewith illustrated have suggested themselves to me during the handling of quantities of angular mills on taper shanks. Bevel protractors now on the market are not well adapted for measuring the angle of the cutting edges of these mills, but with the aid of the appliances to be described, a Starrett protractor can be made available for measuring any angle required on mills of this length, 1.50 to 1.60 in. and 0.35 0.50 in. in diameter.

A glance at Fig. 1 will show how some of the angles of the cutting edges are measured. *A* is a hardened-steel shell with six flat surfaces ground on its circumference, perfectly square with its ends, and parallel with the hole in it, and so that the shell can locate itself and be secured against the shoulder by means of a washer and screw.

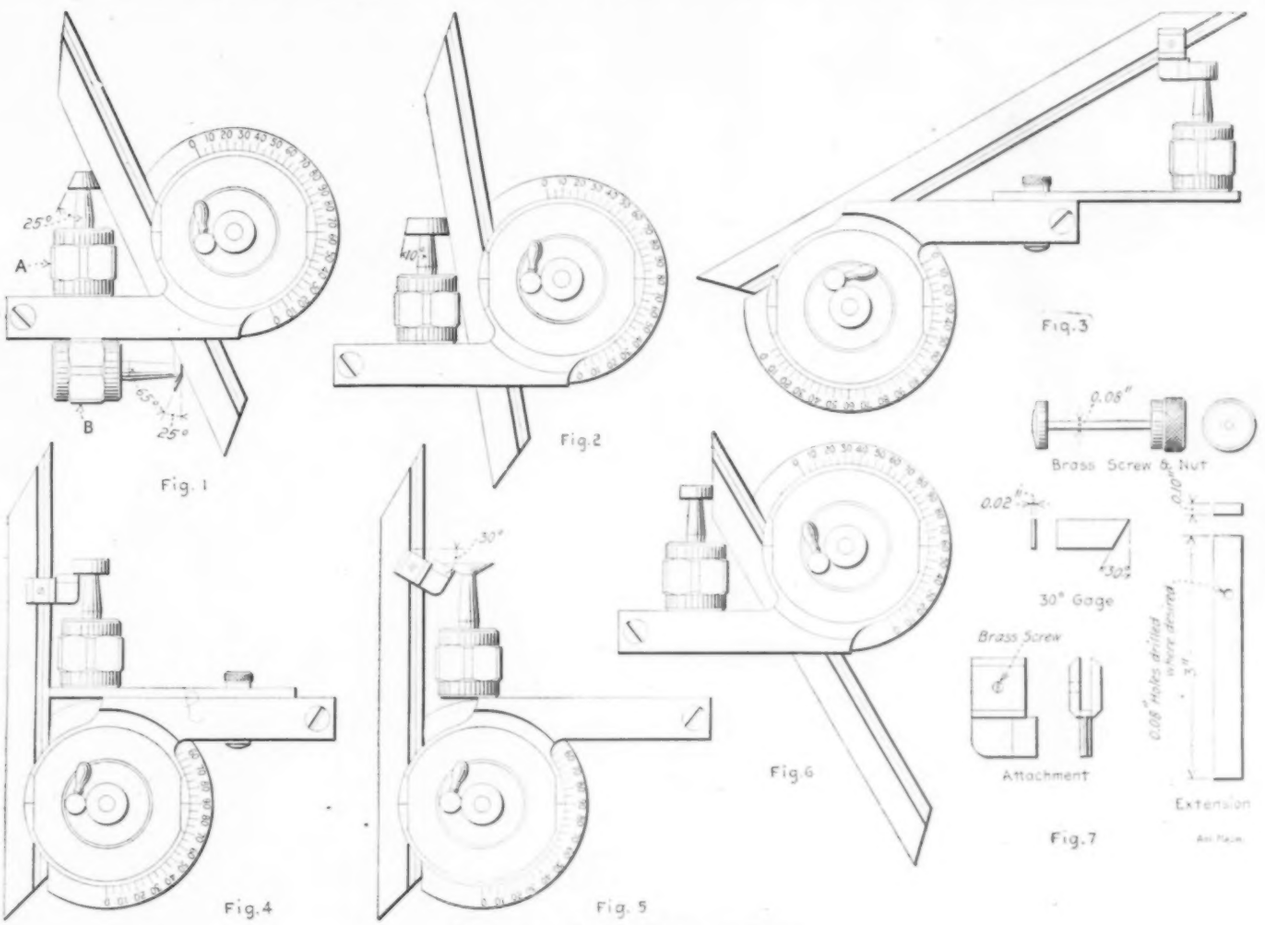
To anyone interested in the method contains a bushing with a standard taper hole for the shanks on the mills.

Originally this shell was simply knurled, but while using it as at *A*, in Fig. 1, the value of the flats becomes apparent. Making the shell is not a difficult job, as the ends can readily be ground and lapped square with the hole, and the flats can be ground square with the ends by mounting on a solder chuck, which should have a short stud turned and tapped at its end, employed to grind the flats, I refer them to Vol. 34, page 506, of the AMERICAN MACHINIST, where an illustrated description will be found of a method which will give accurate results. Returning to Fig. 1, it will be noticed that all of the angles cannot be measured, as shown at *A*, since the corner of the shell strikes the blade of the protractor in advance of the cutting edge of the mill to be measured, as in Fig. 2, also as the angle to be measured increases, the shell must be moved until it is finally crowded off.

An extension suggested itself at this point, and this is shown in Figs. 3 and 4, but it is not necessary to use it for angles running in the direction shown in Fig. 1, as all the angles but about 15 deg. can be obtained as at *B*, Fig. 1. The remaining 15 deg. or more can be obtained, as in Fig. 6.

For measuring the angles in the contrary direction, the extension and other attachment, the details of which are shown in Fig. 7 are used. Fig. 3 illustrates the use of the combination, and a 90-deg. mill has been made to show clearly that all of the angles can be measured. The attachment is first set at an angle of 30 deg., with the blade of the protractor by means of the gage seen in Fig. 7, also indicated in Fig. 5.

Comparing Figs. 3 and 5, it will be noticed that the shell has reached its limit in the opposite direction in Fig. 5, and that 60 deg. of the 90 deg. can be measured. For the remaining 30 degrees the extension is used and the attachment is set square with the blade as in Fig. 4.



MEASURING SMALL ANGULAR MILLS

The details in the left-hand corner of Fig. 8 are of a gage I have found useful and convenient for gaging taper work. It consists of a case-hardened shell, containing a bushing with standard taper hole, which has been ground off on one side parallel with the taper, leaving an opening about 0.05 in. wide. To one side of this flat surface a portion of a flexible

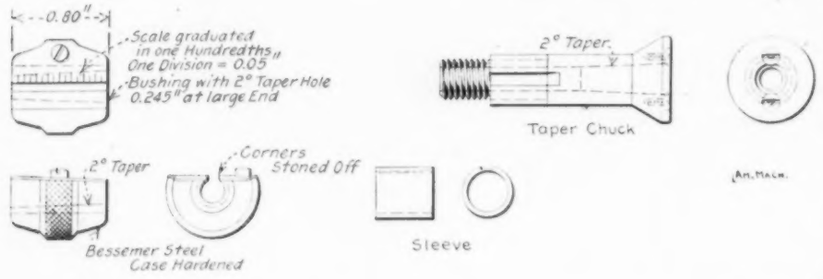


FIG. 8. A TAPER GAGE AND A CHUCK

scale, graduated in hundredths, has been secured with the screw shown.

Before using the gage, I first coat the interior with oil by passing a small piece of moistened sponge through it, instead of marking the work with chalk, lead pencil or otherwise. A fit or misfit is quickly detected on a freshly turned or ground surface with this gage. Sometimes a short taper turned on the end of stock is convenient for chucking purposes, when the scale is useful for noting the amount to be turned off from the work, since the distance the taper will enter the gage for each 0.001 in. removed from the diameter of the work is known.

The taper chuck in Fig. 8 is the result of a personal desire for something better than the ordinary chuck. It is important that the throat portion of these chucks should fit the throat of the lathe, otherwise the chuck must be bored out each time it is removed and replaced in the lathe in order to produce true work.

The practice of indenting the throat portion with the center punch or otherwise upsetting it does not appeal to me. To avoid this practice I turn the chuck about 2 deg. taper, leaving the small end a trifle larger than the outside diameter of the thread, then sweat the sleeve, Fig. 8, onto it. The groove in the sleeve is milled not quite through, and is the same width as the throat pin in the lathe. After hardening the sleeve the groove can be ground through with a grinding wheel.

When the sleeve has been sweated on, it should be ground to fit the throat of the lathe snugly, and the angle of the chuck also trued up; then placing it in the lathe head the front end may be bored taper to receive the plug, which is driven in tight, then bored to the required taper and secured by two screws.

Exhibitors at the Master Mechanics' Convention

The exhibition, which has been a feature of the convention of the American Railway Master Mechanics' and Master Car Builders' Association for so many years, was larger than ever this year, and in spite of over 7000 sq.ft. of additional floor space, more than 75 applicants could not be accommodated.

The total exhibition space was over 83,500 sq.ft. Among the 262 exhibitors were: Ajax Manufacturing Co., Cleveland, Ohio; American Brass Co., Ansonia, Conn.; American Infusion Steel Process Co., New York City; American Pulley Co., Philadelphia, Penn.; American Tool Works Co., Cincinnati, Ohio; American Vanadium Co., Pittsburgh, Penn.; Baker Brothers, Toledo, Ohio; Baush Machine Tool Co., Springfield, Mass.; W. N. Best, New York City; Bethlehem Steel Co., South Bethlehem, Penn.; S. F. Bowser & Co., Inc., Fort Wayne, Ind.; The Bullard Machine Tool Co., Bridgeport, Conn.; The Carborundum Co., Niagara Falls, N. Y.; Carnegie Steel Co., Pittsburgh, Penn.; Chicago Pneumatic Tool Co., Chicago, Ill.; The Chisholm & Moore Mfg. Co., Cleveland, Ohio; Crane Co., Chicago, Ill.; Crosby Steam Gage & Valve Co., Boston, Mass.; Crucible Steel Co. of America, Pittsburgh, Penn.; Davis Boring Tool Co., St. Louis, Mo.; Davis-Bournonville Co., New York City; Jos. Dixon Crucible Co., Jersey City, N. J.; The Duff Manufacturing Co., Pittsburgh, Penn.; Duntley Pneumatic Tool Co., Chicago, Ill.; Electric Controller & Manufacturing Co., Cleveland, Ohio; The Walter H. Foster Co., New York City; General Electric Co., Schenectady, N. Y.; Gilbert & Barker Manufacturing Co., Springfield, Mass.; Goldschmidt Thermit Co., New York City; Gould & Eberhardt, Newark, N. J.; Greene, Tweed & Co., New York City; Halcomb Steel Co., Syracuse, N. Y.; Edwin Harrington, Son & Co., Inc., Philadelphia, Penn.; Higley Machine Co., New York City; C. W. Hunt Co., West New Brighton, N. Y.; Independent Pneumatic Tool Co., Chicago, Ill.; International Oxygen Co., New York City; Jenkins Bros., New York City; Wm. Jessop & Sons, Inc., New York City; H. W. Johns-Manville Co., New York City; Jones & Laughlin Steel Co., Pittsburgh, Penn.; The Joyce-Cridland Co., Dayton, Ohio; Keystone Drop Forge Works, Chester, Penn.; Landis Machine Co., Waynesboro, Penn.; Lucas Machine Tool Co., Cleveland, Ohio; The Lunkenheimer Co., Cincinnati, Ohio; Main Belting Co., Philadelphia, Penn.; Manning, Maxwell & Moore, Inc., New York City; The Midvale Steel Co., Philadelphia, Penn.; The Alexander Milburn Co., Baltimore, Md.; Geo. M. Newhall Engineering Co., Philadelphia, Penn.; Newton Machine Tool Works, Philadelphia, Penn.; Niles-Bement-Pond Co., New York City; Norton Co., Worcester, Mass.; Norton Grinding Co., Worcester, Mass.; A. Norton, Inc., Boston, Mass.; Oxweld Acetylene Co., Chicago, Ill.; Pennsylvania Flexible Metallic Tubing Co., New York City; Pneumatic Jack Co., Inc., Louisville, Ky.; Reliance Electric & Engineering Co., Cleveland, Ohio; Richmond Staybolt Drilling Machine Manufacturing Co., Richmond, Va.; Wm. Sellers & Co., Inc., Philadelphia, Penn.; Shelby Steel Tube Co., Shelby, Ohio; Sprague Electric Works of the General Electric Co., New York City; Standard Roller Bearing Co., Philadelphia, Penn.; The Tabor Manufacturing Co., Philadelphia, Penn.; Topping Brothers, New York City; Union Spring & Manufacturing Co., Pittsburgh, Penn.; The Van Dorn & Dutton Co., Cleveland, Ohio; Vixen Tool Co., Philadelphia, Penn.; The Warner & Swasey Co., Cleveland, Ohio; Watson-Stillman Co., New York City; The Westinghouse Machine Co., East Pittsburgh, Penn.; Wilmarth & Morman Co., Grand Rapids, Mich.; The Yale & Towne Manufacturing Co., New York City.

A recent ruling of the Wisconsin tax commission regarding machinery has aroused the manufacturers of Wisconsin. Up to this year all machinery has been taxed as personal property. Under the new ruling machinery is to be assessed this year as real estate in cases where the company owns the building in which the equipment is located. Where the company rents its building, the machinery is to be assessed as personal property. Assessment is already being made in Milwaukee under this new ruling. Under it, the man who leases his building is money ahead of the man who has added to the wealth of the community by erecting his own building. The latter can only deduct the taxes on his machinery with that of other real estate from his income in preparing his statement. The man who leases a building has his machinery assessed as personal property and he can take his personal property receipt and turn it over in payment of his income tax, dollar for dollar. The constitutionality of the ruling is being questioned.

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OUTLINE OF TOPICS, PAGE 165

American Machinist

From Simple to Companion Processes

Important changes sometimes take place so gradually that we fail to recognize their meaning. We fail to see the importance of the advance, as it comes as a matter of course. These statements seem to be true today in regard to some fundamental machining processes.

We have advanced from the age of simple processes to that of companion processes. But an acquaintance with many machine shops shows that the change has not been generally recognized to the degree that its importance deserves.

The basic machine-shop processes are two: Turning and planing. (To forestall objections, it will be recognized that drilling is merely a form of turning.) The first produces all kinds of surfaces of revolution, the latter plane surfaces. The corresponding simple machine tools are the lathe and planer.

The advance of machine-shop practice has modified these basic processes so that today they are no longer simple, but, if you will, compound. In producing surfaces of revolution we must put side by side as companion operations, turning and grinding, and for plane surfaces, planing and milling.

The general manager of a large machine-tool building firm characterizes the present as "The age of turning and grinding, planing and milling."

The parallel lines of development are closer than perhaps at first appears. The simple process of turning uses a single-pointed tool. The companion process of grinding uses a multiple-pointed tool. Similarly the operation of planing is done with a single-pointed tool, and milling with a many-toothed cutter.

It may not be unprofitable to sketch some of the factors that have brought about this evolution. The grinder has been perfected to meet the demand for accuracy. It has been said that the automobile would not have been a commercial possibility, from the viewpoint of manufacture, had it not been for the marked advance in grinding as a machining process.

The development of the lathe kept pace with the development in machine-shop practice up to and through the time when the accuracy of machine-tool parts was a much emphasized feature. A few years ago the most talked about element in a machine tool was the accuracy with which its parts were made and fitted. Now we hear about production, its accuracy and its quantity. That is, the accuracy that machine-tool builders put into their own machines is now demanded in like degree in the parts that those machines produce for other lines of machinery.

This demand for accuracy at once reflected itself in the processes. The possibilities of the grinder as a means of producing cylindrical surfaces to close limits, with an excellent finish and at low cost were at once recognized. Combined with all this came cheaper abrasive wheels of uniform quality. The knowledge of how to build machinery accurately, gained through the development of simple process machines, was ready for use These, as we see it, are some of the important causes contributing to the change from the simple operation of turning to the companion operations of turning and grinding. We say companion processes for, of course, turning has not, and never will be, superseded.

The development of milling as a companion process to planing has taken place during the same period but for somewhat different reasons. Originally the miller was intended for a limited class of work, that is, formed work of complex shape. As it became better known, it was heralded as a machine that would supersede the planer. Everything was to be milled. This enthusiastic prediction never has been realized and, of course, never will be

Some work, for illustration, the finishing of parts having surfaces that are to be scraped and fitted, is generally done on the planer. This is not universally true, as some scraping is done after the miller, and some after the surface grinder. But in general, scraped surfaces are first planed.

It is, however, not our purpose to draw a line between the class of work that is, or should be milled. We shall be glad if some of our readers see fit to take up this matter and try to dispose of it.

The development of milling has come about with the recognition that as a process it is adapted to a wide range of work, that is work, outside of complex shapes, the field for which it was first developed. During the last two years the possibilities in surfacing on a miller using cutters with wide-spaced teeth has been recognized. The summation of the entire development places milling as a companion process to planing. That is, the simple process of planing in the production of flat surfaces, has been superseded by two companion processes, planing and milling.

Thus we think that the quotation given above is amply justified. We are now in the age of turning and grinding, planing and milling.

Wages and Cost of Production

All manufactureers know that while wages are an important factor in the cost of production, they are often able to advance wages and reduce cost at the same time by the introduction of improved machinery and methods. Railroad managers, however, do not seem to have yet learned that such a procedure is within the realms of possibility.

They are constantly demanding, and in many cases securing, the right to advance either passenger or freight rates, as the only means of maintaining their earnings in the face of advancing wages and supplies. It is natural, therefore, that the employees of the railroad should consider an advance in rates as a necessary accompaniment to the desired increase in wages.

As this is a question which affects us all, it is well to look at the matter from the standpoint of the manufacturer in other lines, and a careful study will soon

show that many of his methods can be adopted to advantage.

In manufacturing, the burden or overhead expense is very carefully watched and new equipment is not purchased unless there is a promise of more economical production. The manufacturer does not buy machines which cost more to keep up, unless he is convinced of a saving in the net cost of producing whatever article he may be making. As his cost of maintenance, his power charges, and everything which is not actually productive, go into his overhead expenses, he considers them all in selecting and operating his equipment.

A single instance of modern railroad management shows how antediluvian their methods really are and gives an insight into the reason for their high operating costs.

The item of fuel is about 12 per cent. of the total cost of railroad operations in the United States, and 25 per cent of the cost of conducting transportation. Yet it has received practically no attention since the temporary passing of the compounds.

Even the most ardent advocate of the compound locomotive will admit that the cost of repairs is at least as high, and will probably be somewhat higher, than with the simple locomotive. And as the cost of maintenance falls on the motive power department it naturally endeavors to select locomotives which can be kept at work at as low a cost as possible. The cost of fuel, however, does not interest it in the least, as this falls on the transportation department, and as the word "coöperation" seems unknown between these two departments, and the total cost of producing transportation is of no particular interest to either department, we see one reason for the high cost of fuel.

The fact that a certain type of locomotive will save 10 or even 20 per cent. of fuel does not interest the motive power department, while a possible slight increase in maintenance is enough to enlist its opposition. As the type of motive power is selected by that department, while the transportation department pays all the fuel bills, it is easy to see why the saving of fuel has not received more careful attention. This is simply one of many instances where money is wasted in railway operations, and there are others equally glaring.

Without recommending any particular system of management, scientific or otherwise, it seems as though a few wholesome lessons might be learned from successful manufacturers of machinery and other products. In fact we might even go so far as to suggest that a little more attention to modern business methods, and a little less to the manipulation of the stock ticker, might help to bring our railroads nearer in line with twentieth century business methods than they are at present.

New Publications

HAWKINS MECHANICAL DICTIONARY. By N. Hawkins; 665 pages, 6x8½ in. Published by Theo. Audel & Co., New York. Price, cloth, $2; half leather, $3.50.

This is the most complete book of the kind which has been issued in recent years and while it is impossible to make any single volume contain all that we ever need, it will be found very useful as a reference.

The arrangement of words and definitions makes it easy to pick out the desired information at a glance, and the names and terms are not confined strictly to the field of mechanics. No illustrations are used.

THE STEAM TURBINE. By Robert M. Nielson. Fourth edition; cloth; 651 pages, 6x9 in.; 415 illustrations in the text; indexed. Longmans, Green & Co., New York. Price, $5, net.

In this edition the greater part of the previous edition has been rewritten. Much new material has been added and some previously used material excluded. Among the latter is the chapter explaining entropy—temperature diagrams.

Because of a confusion in meaning, the term "adiabatic" has, the author states, been avoided with regret. The wisdom of this course is questionable, as it is not difficult to define and then use a term, provided there is not any haze as to its exact or usually accepted meaning.

The most recent developments in design are treated in Appendix III. Appendix IV has been extended to include the patent specifications of the year 1911.

TECHNOLOGY AND INDUSTRIAL EFFICIENCY. 486 pages, 6½x9½ in.; illustrated. McGraw-Hill Book Co., New York. $3, net.

This volume gives in abbreviated form the papers presented by the alumni and members of the faculty of the Massachusetts Institute of Technology at the convention held last year to celebrate the 50th anniversary of the foundation of the Institute.

First in order is the address of President MacLaurin on "Some Factors in the Institute's Success" in which he pays special tribute to the ideals and wisdom of the founder, Prof. Wm. B. Rogers.

The 67 technical papers succeeding this are presented in six sections as follows: Scientific Investigation and Control of Industrial Processes, Technological Education in its Relations to Industrial Development, Administration and Management, Recent Industrial Development, Public Health and Sanitation, Architecture.

The progress of a half century in practically all fields of industry is here reviewed in most interesting fashion. It is hardly possible for one interested in engineering or the industrial problems of our modern life to open the book, even at random, without finding something to attract his attention. A perusal of the names and positions of the graduates presenting the papers would go far to refute the criticisms of the late R. T. Crane on the efficacy of our engineering schools.

THE COPPER HANDBOOK, by Horace J. Stevens. Volume X, 1912, pages 5½x8½ in., indexed. Horace J. Stevens, Houghton, Mich. Price in buckram binding, $5; in full morocco, $7.50.

This tenth annual edition of "The Copper Handbook," which is considered a standard authority on the subject of copper and copper mines for the entire globe, lists and describes 8130 copper mines and copper-mining companies, in all parts of the world. This is the largest number of titles ever listed by any work on mining.

The descriptions range from two or three lines in the case of dead companies, wherein reference is made to detailed descriptions in past volumes at the period of their activity, up to 21 pages in the case of the Anaconda mine, which yields one-eighth of all the copper produced in the world.

The 24 chapters treat the subject of copper from all viewpoints, giving the history, chemistry, mineralogy, metallurgy, brands and grades, alloys and substitutes for copper, with a copious glossary. The chapter on statistics contains 40 odd tables covering copper production, consumption, movements, prices, dividends, etc.

The book is sent by mail, prepaid, to any address without advance payment of any sort, but subject to payment or return after a week's inspection.

Personals

E. Rivett, president of the Rivett Lathe Manufacturing Co., Boston, Mass., sailed on June 20, for an extended European pleasure trip.

W. H. Schafer, general superintendent, Cincinnati-Bickford Tool Co., Cincinnati, Ohio, has resigned to accept the position of vice-president and general manager of the Rivett Lathe Manufacturing Co., Boston, Mass.

Frank Salomon, president of the Otto Gas Engine Works, Philadelphia, Penn., sails on July 4, for a six weeks' trip in Germany. Erich Krell, vice-president of the same company, returns on July 1 from a three months' European business trip.

C. E. Clewell, illuminating engineer with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn., and well known to our readers through his frequent and comprehensive articles on the subject of shop lighting, has accepted the position of assistant professor of electrical engineering at the Sheffield Scientific School, Yale University, New Haven, Conn. Mr. Clewell will retain connection with the Westinghouse company in a consulting capacity.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

2¼ x 26-in. Turret Lathe

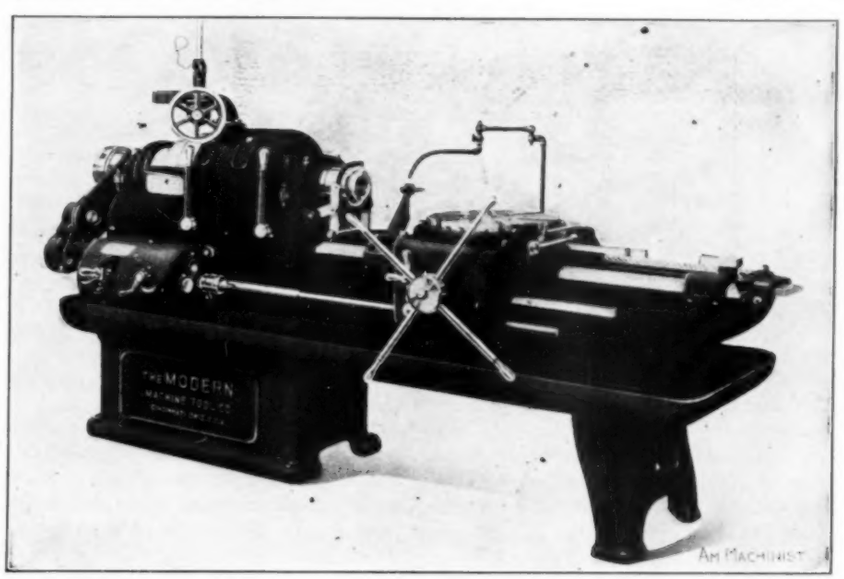
An idea of the general construction of this turret lathe will be gained from the illustration. The head contains the cone pulley for driving the machine, the friction back gears and the automatic roller feed and chuck. The cone and gears give the machine 12 spindle speeds in geometric progression, ranging from 24 to 465 r.p.m. The bed rests on a three-point bearing, and is reinforced under the front spindle bearing.

The belt shifter is operated by the handwheel in front of the head. The motion from the handwheel is transmitted to the belt loop through an intermittent rack and pinion. A similar device is suspended from the countershaft and operates in unison with the device on the head through knuckle joints and connecting rod.

A single movement of a lever in front of the head operates the automatic chuck and automatic roller feed. The head is friction-back-geared and is cast integral with the bed. The feed gear box provides 8 feeds ranging from 0.005 to 0,085 in. per revolution of the spindle. Motion from the feed box is transmitted through a disk friction and knuckle joint through the carriage feed rod.

Bar stock up to 2¼ in. in diameter can be fed through the chuck and turned any length up to 26 in. The swing over the bed is 20 in.; over the carriage, 16 in. The turret is 18 in. in diameter.

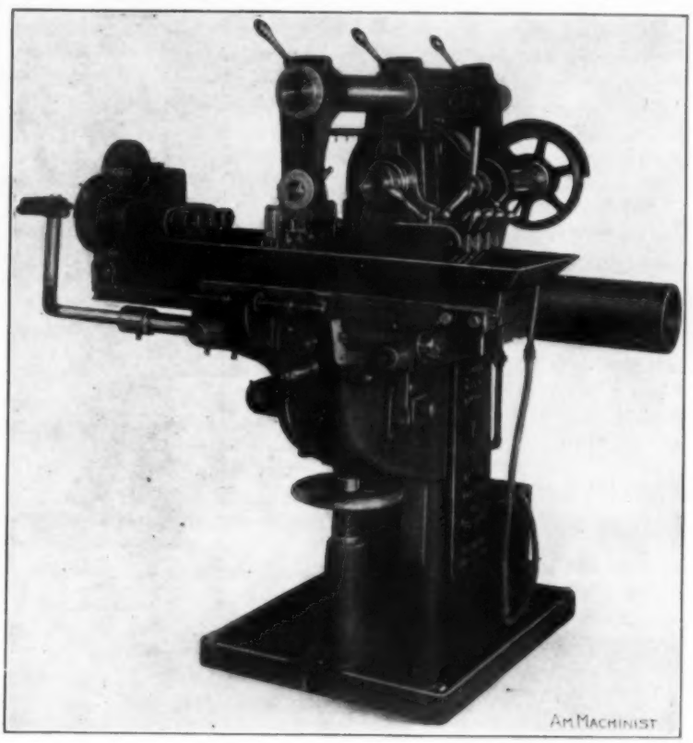
The machine weighs 4500 lb., occupies a floor space of 4x11 ft., and is a recent product of the Modern Machine Tool Co., Cincinnati, O.



2¼x26-IN. TURRET LATHE

Automatic Index Miller

The machine shown in the illustration is used for the automatic fluting of taps, reamers, the cutting of gears, ratchets, etc., and is adapted to the automatic performance of repetition work. The modifications introduced comprise quick-acting, work-holding apparatus, automatic index, automatic feed with quick return by a long spring, checked by an air cushion, and automatic stoppage of the machine when the work is completed.



AUTOMATIC INDEX MILLER

On finshing the cut the machine is tripped by a dog shown to the left of the table, which releases the latch, allowing the worm to drop out of mesh with the worm gear. The table is then free from the power feed, and is rapidly drawn back to the other extreme of its travel by an inclosed spring at the rear of the table. This rapid motion is checked before the table reaches its fixed stop by an air cushion.

When the dog trips the machine, the stop collar shown on the screw along the front of the table comes in contact with the bracket and trips the tilting table by means of a camshaft, thus allowing the

return of the work without the cutter dragging. As the table approaches the extreme return position, the right-hand dog on the table strikes the stop plunger, bringing the worm back in mesh with the worm gear at the same moment that the table comes to rest.

When the table comes to rest, the right-hand stop collar shown on the screw along the front of the table lifts the tilting table back to its work position, and also lifts the index pawl, so that the dial can index, then lets it fall back instantly.

The machine will take 16 in. between centers, and a cut 7½ in. long can be taken anywhere in this distance. The centers have a capacity for holding work on all four spindles up to 2 in. in diameter, and on the two outer spindles up to 4 in. in diameter.

This machine was recently developed by the Garvin Machine Co., New York, N. Y., and is known as its "No. 13½ Automatic Index Miller."

Portable Steel Tool Rack and Work Stand

The portable steel tool rack or work stand shown in the halftone is made in two sizes, 20x26 and 26x32 in., by the

PORTABLE STEEL TOOL RACK AND WORK STAND

New Britain Machine Co., New Britain, Conn.

In design these racks are similar to those made of cast iron by this company. The rounded internal corners of the pans make them easily cleaned, and the return flanges on the edges stiffen them. The lower pans may be set at any desired height.

In all the trays the holes for brace rivets or legs come to the top edge of the pan where they cannot impair its oil tightness. The casters are made with ball-bearing swivel.

Combination Drill and Universal Grinder

This new grinder made by the Wilmarth & Morman Co., Grand Rapids, Mich., is a combination drill and universal grinder which, besides drill grinding, may be used for grinding forming cutters, gear cutters, angle cutters, side mills, hobs, taps and reamers, as well as for internal or surface grinding.

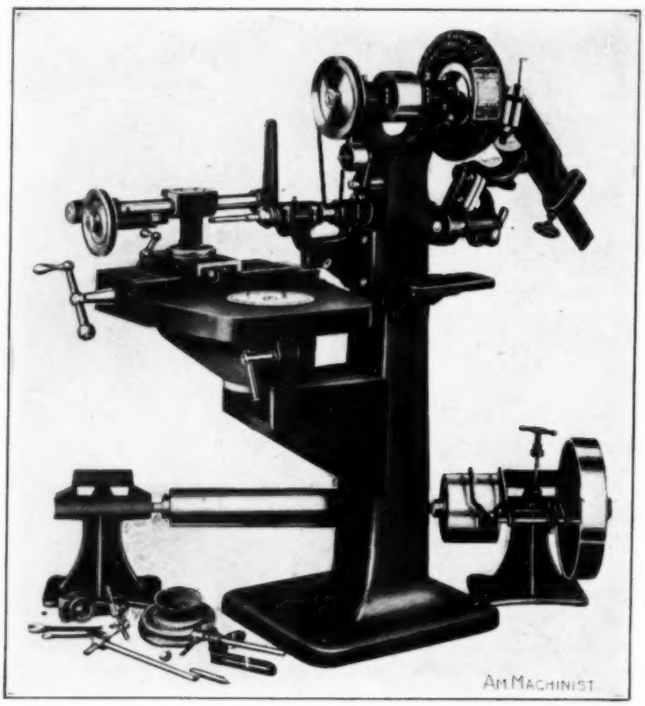


FIG. 1. DRILL AND UNIVERSAL GRINDER

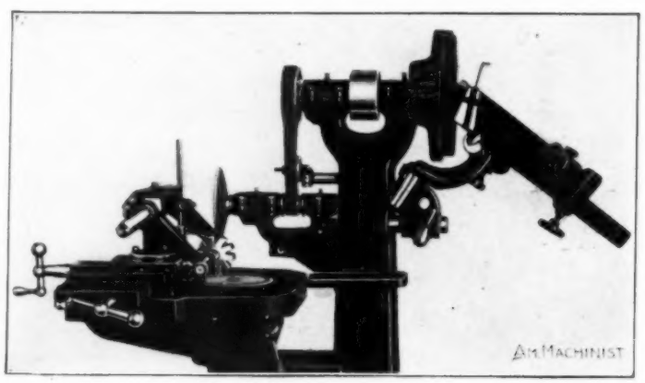


FIG. 2. GRINDING A FORMED CUTTER

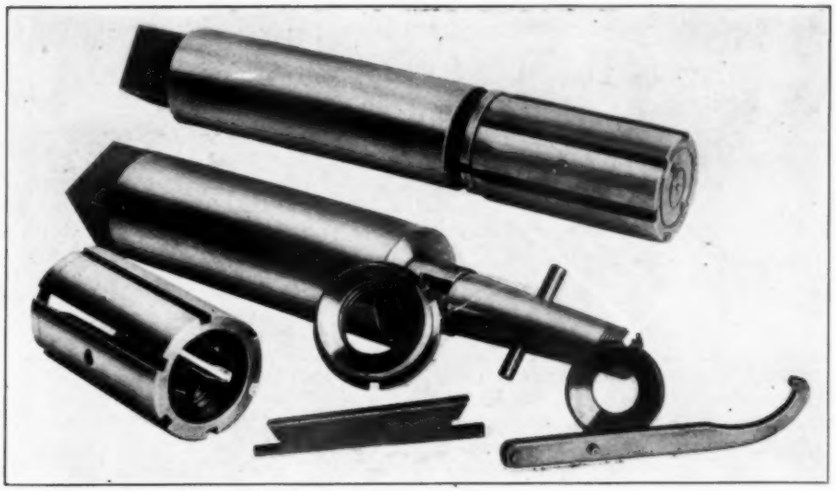
It will grind side mills up to 12 in. in diameter and angle cutters up to 8 in. in diameter. The distance between centers is 17 in. Cylindrical work, straight or taper, 7½ in. in diameter by 11½ in. long may be ground. It occupies a floor space 21x46 in., weighs 488 lb. net, and 715 lb. boxed.

The machine with the internal grinding attachment in place is shown in Fig. 1, and Fig. 2 shows it set for grinding formed cutters or similar work.

Precision Adjustable Reamer

The precision adjustable reamer shown is a recent development of the Cincinnati Precision Lathe Co., Cincinnati, Ohio. It consists of a steel shell slotted all the way through, excepting at each end, which is fitted to a taper shank and held in position by a taper pin, passing through both shell and shank.

The shell being slotted all the way through permits the cutting blades to rest directly upon the tapered shank, which is threaded at each end of the taper for the adjustment of angle collars, which retain and adjust the blades by a movement up or down the tapered shank. By employing a cylindrically ground shank



PRECISION ADJUSTABLE REAMER

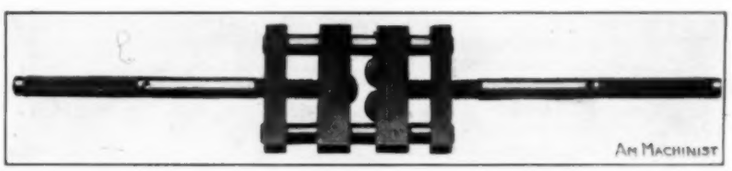
as a seat for the reamer blades, a fine degree of accuracy is obtained.

The blades are readily adjusted, so as to have each one cut in reaming. By reversing the adjusting collar next to the body and following with the adjusting collar to the end of the taper shank, the blades are moved up the taper and remain concentric to the body of the reamer. These blades are clamped down to the taper shank by means of the 30-deg. angle in the collars, which engage the ends of blades. The threads and inner working parts are amply protected from cuttings.

Knurling Tool

The design of this knurling tool will be readily understood from the illustration.

The object to be knurled is placed in the vise and the tool started as if it were a tapping operation. The tool leads itself up or down the work in the direction the object is rotated, and feeds $\frac{1}{32}$ in. per revolution.



KNURLING TOOL

This knurler was recently developed by A. B. Campbell, Fairport, N. Y.

Printing Small Circles

BY G. HEYSLER

The drawing of small circles with ordinary instruments presents considerable difficulty to an amateur. Indeed, my results on some work were so unsatisfactory that I was obliged to change my course in order to obtain satisfactory drawings.

As a matter of expediency small circles are enlarged in working drawings, but in some cases, *C* in the accompanying figure for instance, the only reason for enlargement would be perhaps, on account of the four or five smaller holes.

This is a practical example of work, and an exact copy of it was wanted on paper. With the drawing instruments at hand it was impossible to draw the smaller circles. Having noted many small circles illustrated in the AMERICAN MACHINIST and technical books the idea of printing them occurred to me as a means of solving the problem.

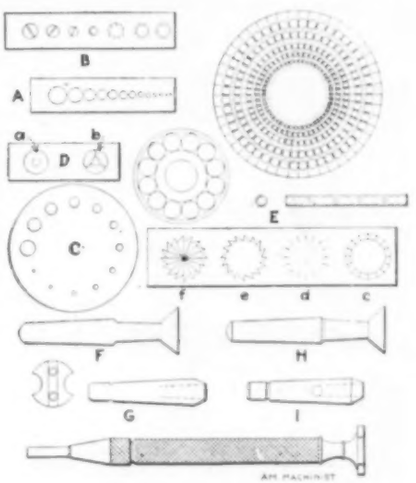
Making the type for printing these circles is a simple process. Pieces of 0.10-in. steel wire were chucked in a collet, then turned to size and centered nearly to the circle, leaving a narrow rim for the ink. The type was used in place of the screwdriver blade in the Starrett holder shown, the inking being done with a self-inking stamp pad.

All of the circles shown at *A* were printed in this manner, the larger ones having a shank turned on them to fit the holder. The standard screw heads, double circles, and broken circles *B* were also printed. All that is necessary in the case of screw heads is to slot the type. This leaves the type divided, then the extremities of the arcs may be joined in the print. To print the double circles the type is centered deep enough for the inner circle, then the space between this and the outer circle is recessed.

For the double broken circles the type is slotted through both circles, while in the other case the outside circle only is slotted. *D* shows another case in which *a* represents the face of the type divided into three arcs, the extremities of which are joined in *b* showing the face of a small drill chuck; *c* shows the face of the type, *d* is the print, the diagonals in *e* converting it into what may represent the end view of the mill *H*, or a saw, while the radial lines in *f* convert it into a view of an end mill or a ball mill.

The letters *F* and *G* show the outlines of a standard mill and adapter which were drawn from steel templates, then touched up as in *H* and *I*. The template for the mill can be used for any angle of cutting edge as the angle is determined by the length of the line representing the largest diameter of the mill.

I have found the template useful in quickly making a memorandum of mills of different angles, for the reason that some drawings show an enlarged mill



PRINTING SMALL CIRCLES

(not altogether to any scale) which serves as a symbol for several mills of different angles, but gives the workman no idea of what the mill looks like when made. The remaining examples of circle work are but a few of many similar ones observed in watch factories, and the type makes it possible to secure exact copies of work which would otherwise be done with difficulty.

Data on Boring and Facing Cutters

A correspondent asks for the best angles to grind boring and facing cutters, to be used in boring bars, to cut babbitt, brass, cast iron and mild steel. He further asks for the best sections of steel to be used in making such cutters for a line of bars $\frac{3}{4}$x1$\frac{1}{4}$, 1$\frac{1}{2}$, 2, 2$\frac{1}{2}$, 3 and 4 in. in diameter.

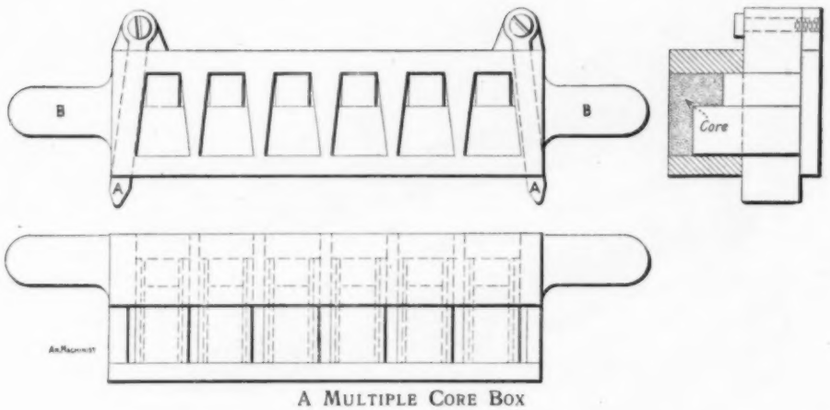
We shall be glad to have readers send us their practice, in making and using such cutters, for publication in these columns.—EDITOR.

A Multiple Core Box

By George Buchanan

The illustration shows a gang core box, which has proved extremely useful in fulfilling the purpose for which it was made, viz., that of quickly producing cores of accurate and uniform size.

Previous to using this core box, a solid box was employed and cores of varying sizes were quite the usual thing, as a certain amount of rapping was necessary to loosen them. As a result of this variation in size, complaints were frequent, as a small casting fits into the hole which this core makes around the rim of a wheel.



A Multiple Core Box

There are 12 holes to each wheel and the number of wheels made per season is about 6000, so that the extra fitting of three small castings was rather a big item. However, by the use of this core box, holes were obtained which caused complaints to cease at once.

In operation, the core box is given a little paraffin oil and the cores rammed hard; the two swiveling pieces *A* are swung around from under the box and the handles *B* pressed down, causing the box to slide down, leaving the cores stripped, ready for lifting off without any trouble.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND

The Bath Iron Works, Bath, Me., are to build a large concrete blacksmith shop, 120x60 ft.

The Randall-Faichney Co., Boston, Mass., is constructing a new factory at Jamaica Plain, Mass., for the manufacture of automobile accessories. Noted June 6.

The building at 62–64 Portland St. and 36–40 Sudbury St., Boston, Mass., was burned, June 12. The building was occupied in part by: Holt & Beebee, manufacturers of automobile equipment; W. J. Sheridan, brass finisher: and F. E. Hunt, box manufacturer. Loss, $50,000.

The Griffen Wheel Co., Tremont Bldg., Boston, Mass., is having plans prepared for the construction of a foundry, one-story high, 37x80 ft., in Chelsea, Mass. Noted June 6.

The John Dennis Machine Co., Lowell, Mass., is building an addition, 33x40 ft., two stories high.

The Boston & Maine R. R. will build a car and locomotive repair plant containing 20 shops, at North Billerica, Mass. The estimated cost is $2,500,000. A. B. Corthell, Boston, Mass., is ch. engr.

Nelson E. Elmer, Springfield, Mass., will build a new garage on Cross St., to be three stories high, 71x110 ft., of brick and concrete. The estimated cost is $32,000.

The Stevens-Duryea Automobile Co., Springfield, Mass., is having plans prepared for the construction of four new buildings. One will be 80x1008 ft., four stories high, another 600x80 ft., two stories high, and the other two, 80x600 ft., one story high. All will be of brick and steel.

Dr. G. Fred Hart, Webster, Mass., is erecting a large commercial garage on Mechanic St. A fully equipped repair and machine shop will be installed on the second floor.

Charles H. Hildreth, Worcester, Mass., will erect a commercial garage, 57x155 ft., to cost $12,000 E. T. Chapin, State Mutual Bldg., is the arch. Noted June 6.

J. H. Wheelock, Worcester, Mass., will erect a garage at No. 3 Moore Ave., to cost $3,000.

The Spencer Wire Co., Worcester, Mass., will erect a garage, at No. 78 Webster St., to cost $3,000.

The Lorraine Mfg. Co., Pawtucket, R. I., is building a new machine shop, two stories high.

Plans have been prepared by C. T. Beardsley, arch., Bridgeport, Conn., for the construction of an addition to the plant of the American Graphophone Co. It will be 54x50 ft., one story, of brick.

The United Foundry & Machine Co., Bridgeport, Conn., will erect a new factory, 100x160 ft., at its plant.

Bids are being received by I. R. Blumenthal, Hartford, Conn., for the construction of a garage, 43x106 ft., two stories high, on North Main St. Noted May 30.

Work has recently been started on the construction of a new factory for Potter & Snell, manufacturer of buttonhooks, Deep River, Conn. It will be 41x150 ft., one-story, of brick.

The International Silver Co., Meriden, Conn., manufacturer of silverware, will erect a five-story addition to its plant on Miller St.

The Winchester Repeating Arms Co., New Haven, Conn., has awarded a contract for the construction of a six-story addition, 57x132 ft. The estimated cost is $75,000.

The Autoyre Co., manufacturer of metal goods, has been organized at Waterbury, Conn., with a capital of $200,000, and has purchased the factories of the Baird Machine Co., at Oakville. New equipment will be installed. Julius H. Cowles is one of the incorporators.

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., has awarded the contract for the new machine shop to be erected at Bank and Meadow Sts. It will be 68x184 ft., one story high, of brick. Griggs & Hunt are the archs. Noted June 20.

The Geometric Tool Co., Westville, New Haven, Conn., is erecting an addition to its plant.

MIDLE ATLANTIC.

W. J. McChesney, Albany, N. Y., has been granted a permit to erect a tile and concrete garage at 509 Western Ave.

The Johnson Harvester Co., Batavia, N. Y., has awarded a contract for the construction of a reinforced concrete building, 85x150 ft. Noted May 16.

Gustav Erda, arch., 861 Manhattan Ave., Brooklyn, N. Y., is preparing plans for the construction of a new garage for C. P. Rouss. It will be two stories high, 36x125 ft., and will cost $15,000.

The garage of Henry Sands at Farmingdale, L. I., N. Y., was wrecked by an explosion, June 16. Loss, $50,000.

The Morse Chain Co., Ithaca, N. Y., has awarded a contract for the construction of a machine shop, 62x253 ft., at its plant.

The Covert Motor Vehicle Co., of Lockport, N. Y., is planning to construct a large addition to its present plant, which will treble the capacity.

John C. Heintz and Jacob Siegel, 3582 Third Ave., New York, N. Y., have had plans prepared for the construction of a new three-story garage, 52x108 ft. The estimated cost is $45,000. Mortenson & Co., 114 East 28th St., are engrs.-in-charge.

Thomas F. Devine, West End Ave. and 64th St., New York, N. Y., contemplates the erection of four 50x100 ft. garages on the west side of West End Ave., between 63d and 64th Sts.

Clark Bros., makers of wood-manufacturing machinery, are reported to be considering the construction of a plant at Olean, N. Y., to replace the one at Belmont, recently burned. Noted May 23.

The Case Bros. Cutlery Co., manufacturer of tableware, Springville, N. Y., has awarded the contract for the construction of a new factory. It will be of steel and brick, 90x100 ft.

The Schenectady Coal Co., Schenectady, N. Y., has awarded a contract for the construction of a new garage, one story high, 22x261 ft. Oren Finch, State and Jay Sts., is the arch.

The Plaza Garage, Ridgewood, N. J., was wrecked by an explosion, June 16. Loss, $7,000.

All bids received recently for the erection of a complete manufacturing plant at Second and Duncannon Sts., Philadelphia, Penn., for the Germantown Tool Works, 521 Market St., have been rejected. The owners will receive new bids on the entire group of buildings. The seven buildings will all be of reinforced concrete construction, one and

two stories, each 30x100 ft. John G. Brown, Witherspoon Bldg., is the Arch. and Engr.

The Pennsylvania Galvanizing Co., of Philadelphia, Penn., has awarded the contract for the construction of a 100x132 ft., one story, brick garage, at an estimated cost of $12,000. Noted June 6.

I. M. Henry is building a 37x113 ft., two story, garage at 55th and Walnut Sts., Philadelphia, Penn. It will cost about $5.000.

The Phialdelphia Rapid Transit Co., Philadelphia, Penn., will soon start work on the construction of a new terminal buliding and repair shops at Erie Ave. and York Road. The estimated cost is $500,000.

Bids are being received by John C. Brown, arch., Witherspoon Bldg., Philadelphia, Penn., for the construction of a factory for the Brady Brass Co., Jersey City, N. J. It will be one and two stories high, 165x100 ft. The estimated cost is $35,000.

Day & Zimmerman, engrs., 608 Chestnut St., Philadelphia, Penn., are preparing plans for the construction of a foundry and machine shop for the Gurney Elevator Co., Honesdale, Penn. It will be 180x280 ft., one story high, and will cost $50,000.

The Reading Steel Casting Co., Reading, Penn., has purchased property and is having plans prepared for the construction of a new plant on the banks of the Schuylkill River.

Davis & Sons Co., of Reading, Penn., will shortly erect a modern one-story brick garage in front of its present machine shop.

The Tin Decorating Co., Baltimore, Md., has taken over the tin plant of the American Tobacco Co., at Charles and Barre Sts., and will enlarge the capacity. The company is also considering plans for the construction of a new plant on Boston St.

M. Solomon, Bayard & Nanticoke Sts., Baltimore, Md., has awarded a contract for the construction of a garage at Whitelock St. and Callon Ave. It will be one story high, 113x115 ft., of mill construction. The estimated cost is $8,000. Henry J. Finley, 312 North Charles St., is the arch.

SOUTHERN STATES

The Berkley Machine Works, Norfolk, Va., will erect a two-story brick building, 40x90 ft.

The Warwood Tool Co., Wheeling, W. Va., will erect an addition to its new plant.

The Whiaker-Glessner Iron Co. has purchased 50 acres of land and will erect a plant near Wheeling, W. Va.

The Merchants & Evans Co., Philadelphia, Penn., will erect a large tinplate plant at Wheeling, W. Va.

The Gibbes Machinery Co., Columbia, S. C., will erect a new plant.

The shops of the Cowart Auto & Accessory Co., 147 Edgewood Ave., Atlanta, Ga., were burned, May 30. Loss, about $14,000. J. M. Cowart is president.

The garage on the ground floor of the English Bldg., Waycross, Ga., was destroyed by fire, June 19. Loss, $30,000.

A large two-story brick garage is to be erected at Granada and Cedar Sts., St. Augustine, Fla., to be occupied by the City Garage & Sales Co.

W. H. Manning, Dayton, Fla., will erect a garage of concrete construction, 52x116 ft., to cost $3000.

Richard Ashby, Miami, Fla., will erect a garage on 13th St.

The Southing Iron & Steel Co., Birmingham, Ala., will equip its furnace and plant with modern machinery.

The Alabama Metal Products Co. will erect a large factory in Gadsden, Ala.

Emmons Bros. contemplate erecting a wire bed spring factory at Meridian, Miss.

The Tennessee Exploration Co., Knoxville, Tenn., will erect a large plant for the refining of spelter.

The Memphis Mining & Mfg. Co., Memphis, Tenn., will erect a blast furnace and make improvements. W. S. Allen, Birmingham, Ala., is pres.

The Tennessee Implement Mfg. Co. will erect a plant at Springfield, Tenn., for the manufacture of farm rollers and other agricultural machinery.

The Cincinnati Locomotive & Car Co., Cincinnati, Ohio, manufacturer of locomotives and contractor's equipment, will move its plant to Covington, Ky. John E. Glenn is pres.

The General Motors Co. Louisville, Ky., will erect an automobile factory.

MIDDLE WEST.

The Whiaker-Glessner Iron Co. will erect a plant in southern Ohio. See item under Wheeling, W Va.

The contract for the construction of the factory and office building for the Akron Rubber Mould & Machine Co., Akron, Ohio, has been awarded to Walter Thompson & Son, Cleveland.

The Knecht Planer Co., Cincinnati, Ohio, contemplates erecting a plant at Alliance, Ohio, for the manufacture of machine tools.

The Lake Erie Iron Co., Cleveland, Ohio, has awarded the contract for the erection of a two-story garage, 36x50 ft., at 600 East 63d St., to cost $3,000.

The Electric R. R. Improvement Co., 6005 Carnegie Ave., Cleveland, Ohio, is building a $15,000 addition to its present factory.

The Cleveland Welding Co., Cleveland, Ohio, maker of automobile parts, will build and equip a new plant to cost $27,000.

A large garage will be built by the Barkwell Brick Mfg. Co., Cleveland, Ohio.

The Angell Nail & Chaplet Co., Sweeney Ave., Cleveland, Ohio, will erect a one-story brick factory.

The F. B. Stearns Co., Cleveland, Ohio, will erect a larger addition to its automobile factory.

Four new merchant bar mills will be constructed at Cleveland, Ohio, by the Republic Iron & Steel Co. Cost, $200,000.

The J. A. Wigmore Co., Cleveland, Ohio, will erect a one-story garage, 247x262 ft.

The Walworth Run Iron Foundry Co., Cleveland, Ohio, will enlarge its plant and add new equipment.

The Cleveland Automatic Screw Machine Co., Cleveland, Ohio, will erect and equip an addition to its factory.

The Standard Tool Co., Cleveland, Ohio, maker of drills, reamers, cutters, etc., will build an addition to its plant.

The W. S. Tyler Wire Co., Cleveland, Ohio, wire maker, will build an addition, 61x110 ft., to its plant. Noted May 22.

The Buckeye Lamp Co., Cleveland, Ohio, maker of electric lamps, will build a new steel and brick factory, 115x163 ft.

The Korb Lithographing Co., Eighth and Main Sts., Cincinnati, Ohio, is having plans drawn for a new factory, 50x100 ft. H. L. Korb is pres. H. E. Kennedy & Co. are the archs.

Bids are being received for a two-story addition, 25 ft.x380 ft., to the plant of the Warner Elevator Co., Spring Grove Ave., Cincinnati, Ohio.

Machine shop equipment will be purchased by the Automatic Tile Machine Co., Cincinnati, Ohio, just organized to build cement tile making machines. A. W. Koch is mgr.

The Electric Laundry Equipment Co., Columbus, Ohio, maker of electric laundry tools, has raised its capital from $50,000 to $100,000. New machine tools will be purchased.

The Timken Roller Bearing Co., 9 Dueber Ave. Canton, Ohio, will erect a one-story brick and steel factory building, 64x250 ft.

The Canton Foundry & Machine Co., Canton, Ohio, has received bids for a two-story foundry, 62x 145 ft.

The Oakwood Street Ry. Co., Dayton, Ohio, has awarded the contract for the erection of a large car barn.

The Barney & Smith Car Co., Dayton, Ohio, is in the market for machine tools.

The Veitch Motor Mfg. Co., Dayton, Ohio, a new concern capitalized at $200,000, has purchased five acres of land and will erect buildings for the manufacture of motor trucks. J. S. Harris is pres.

The Fremont Furnace Co., Fremont, Ohio, has been incorporated for $50,000 by T. C. Harris and others to equip plant to build heating furnaces.

The Miami Cycle Mfg. Co., Middletown, Ohio, has awarded the contract to Cullen & Vaughn, Hamilton, for the erection of a new $60,000 plant. Noted Apr. 11.

The Mansfield Foundry & Mfg. Co., Mansfield, Ohio, will be in the market for foundry equipment and machine shop tools. O. C. Jacob is mgr.

The Thompson Mfg. Co., Newark, Ohio, has completed its plant and expects to install a large amount of machinery to manufacture horse clamps and metal stampings.

The Modern Foundry Co., Oakby, Ohio, will erect an addition to its plant.

The Foos Gas Engine Co., Springfield, Ohio, is building an addition to its plant.

The Hobart Electric Mfg. Co., Troy, Ohio, maker of electrical devices, has raised its capital to $700,000 and will buy new machine tools.

The Edward Thal Co., 1050 Ohio Bldg., Toledo, Ohio, is preparing plans for a three-story and basement factory, 75x118 ft., for the manufacture of motors, wagons, etc. Fred L. Siebert, 350 Ontario St., Toledo, Ohio is the owner. Cost, $25,000.

The Chase-Duniface Co., Toledo, Ohio, recently incorporated, will enlarge its present plant.

The Lewis Electric Welding & Mfg. Co., Toledo, Ohio, will spend $10,000 in remodeling the plant of the Toledo Stove Works, which it recently purchased to manufacture various automobile and motor parts.

A garage costing $10,000 will be erected by the Wyoland Auto Co., Wyoland, Ohio.

The Youngstown Bronze & Iron Foundry Co., Youngstown, Ohio, maker of bronze and iron castings:, has doubled its capital and will add new equipment to its plant.

MIDDLE WEST

The Remy Electric Co., Anderson, Ind., will make improvements to its plant.

The Bass Foundry & Machine Co., Fort Wayne, Ind., will erect a steel boiler shop, 110x300 ft.

The Wayne Oil Tank & Pump Co., Fort Wayne, Ind., is erecting a new shop 70x200 ft.

The Gary Steel Mills, Gary, Ind., will spend $3,000,000 for extensions and improvements to the plant.

Carl G. Fisher, pres. Indianapolis Motor Speedway, Indianapolis, Ind., has started the erection of a two-story auto service and sales building.

The Nordyke & Marmon Co., Indianapolis, Ind., will erect a two-story factory 52x243 ft., to manufacture automobiles and flour milling machinery.

The Cole Motor Car Co. will erect a four-story factory at Indianapolis, Ind. J. J. Cole is pres. Noted Apr. 18.

The P. C. C. & St. L. R. R. Co., Indianapolis, Ind., will erect a one-story roundhouse.

The Muncie Gear Works is constructing a new factory building of concrete and steel at Muncie, Ind. Noted May 2.

The plant of the Jackson Shovel & Tool Works, Montpelier, Ind., was destroyed by fire.

The Michigan Central R. R. Co. will erect new car shops in Bay City, Mich.

The Schwartz Foundry Co., Detroit, Mich., will build a one-story foundry, 107x133 ft., to cost $7000.

The Diamond Co., Detroit, Mich., manufacturer of brass specialties and auto parts, was destroyed by fire. Loss $250,000.

The Van Blerck Motor Co., Detroit, Mich., builder of motor boat engines, was destroyed by fire. Loss $25,000.

The Arthur Colton Co., machine and pattern maker, Detroit, Mich., is erecting a new factory at a cost of $60,000.

The Packard Motor Car Co., Detroit, Mich., manufacturer of motor cars, is building an addition to its plant.

The Star Carburetor Co., Detroit, Mich., manufacturer of carburetors, is building an addition to its plant.

The General Aluminum & Brass Castings Co., Detroit, Mich., has awarded the contract for the erection of a foundry and other buildings to cost $25,000.

The National Iron Works, 973 Bethune Ave., Detroit, Mich., will erect a new one-story factory, 56x150 ft. Cost, $3500.

The third and fourth floors of the Jacobs Power Bldg., Detroit, Mich., were destroyed by fire, June 15. The building was occupied by: Detroit Electro-Plating Co., loss $15,000; covered by insurance. Vulcan Ornamental Iron Co., $10,000, covered by insurance; Eagle Cap Co., $2,500; insurance, $1400; Detroit Pattern Co., $1,000; insurance, $500. Heck Printing Co., $5,000; insurance, $2500. Detroit Mausoleum Co., $7,000; covered by insurance. Abraham A. Jacobs, 100 Rowena St., is owner of building.

The Michigan Central R. R. Co. will erect a machine shop, 62x226 ft., at Detroit, Mich. Cost, $20,000.

Two factory buildings, 90x200 ft. and 60x100 ft., will be built at Detroit, Mich., by the Vanguard Mfg. Co., Joliet, Ill., manufacturer of automobile wind shields. The Allyn Engineering Co., Cincinnati, Ohio, is making the plans.

The R-C-H Corporation, Detroit, Mich., manufacturer of automobiles, will erect a large factory 265x400 ft. Noted June 5.

The Dowagiac Stove Works, Dowagiac, Mich., will erect a two-story factory 126x250 ft.

The Grand Rapids Metal Furniture Co., Grand Rapids, Mich., will erect a factory building to cost about $12,000.

C. Hoertz & Son have been awarded the contract to build the Kindel Bed Co.'s new factory on Garden St., Grand Rapids, Mich.

The Page Auto Hoist & Specialty Co., Grand Rapids, Mich., manufacturer of automobile accessories, is preparing plans for the erection of a large plant.

Charles Coats, 95 South Water St., Aurora, Ill., will erect a garage and light manufacturing building of brick, three-stories, 50x115 ft.

The Aurora Automatic Machine Co., Aurora, Ill., will erect two buildings, 50x250 ft., and 150x250 ft., respectively. C. H. Green is the supr.

The Eastern Moline Plow Co., Bloomington, Ill,, will erect a three-story plant 50x125 ft. F. T. Windle is mgr.

The Chicago Foundry Co., Chicago, Ill., will erect a $15,000 one-story foundry, 100x155 ft.

The Greenlee Foundry Co. will erect a one-story foundry, 241x251 ft., at Chicago, Ill.

H. H. Howard, 38 South Dearborn St., Chicago, Ill., will receive bids for a one-story garage 112x180 ft. W. E. Walker is the arch.

Henry Bushing, 873 Chestnut Place, Chicago, Ill., will receive bids for a two-story garage, 50x100 ft.

The garage of the United Cigar Stores Co., 24 West Maple St., Chicago, Ill., was destroyed by fire, June 6. Loss, $25,000.

The Howard Iron Works, Chicago, Ill., will erect a two-story addition, 150 x 180 ft. to cost $15,000.

The Oxweld Acetylene Co., Chicago, Ill., will erect a three-story welding building, 50x100 ft.

The Wabash R. R. Co., St. Louis Mo., will erect locomotive shops at Decatur, Ill., to cost $750,000. A. O. Cunningham, St. Louis, is chief engr.

The Stover Engine Works, Freeport, Ill., will erect an addition to its plant to be 80 x 200 ft.

The E. J. & E. R. R. Co., Joliet, Ill., received bids June 20, for a two-story locomotive shop, 149x440 ft.

The Red Star Sanitary Vending Co., Rock Island, Ill., contemplates erecting a factory to manufacture sanitary machines.

The Oliver Typewriter Co. will erect a plant at Woodstock, Ill.

P. H. Martin, Green Bay, Wis., will erect a stucco two-story garage 24x20 ft.

The United Refrigerator & Ice Machine Co., Kenosha, Wis., is contemplating an expenditure of $50,000 for an addition to the machine room and factory building.

The Marinette Mfg. Co., Marinette, Wis., has let the contract to the Herman Construction Co. of Antigo for a new factory building.

The I. B. Rowell Co., Milwaukee, Wis., will erect a large plant to manufacture agricultural implements.

The George Brunder Estate, Milwaukee, Wis., has commenced work on the erection of a $45,000 garage at Eighth and Wells Sts.

The Milwaukee Corrugating Co., Milwaukee, Wis., will erect a one and two-story factory to cost $500,000.

August Richter, Jr., Milwaukee, Wis., will erect a garage at Eighth and Wells Sts., to cost $35,000.

The Mitchell Automobile Co., 102 Wisconsin St., Milwaukee, Wis., is receiving bids for the construction of a brick addition to its present building.

Bids will be received by Stanley F. Kadow, arch., 988 Kinnickinnic Ave., Milwaukee, Wis., for a two-story brick machine and blacksmith shop, 43x69 ft., for the Thomas Furnace Co. Cost, $10,000.

The Anker & Holt Mfg. Co., Chicago, Ill., has started the construction of a plant at South Park, Mich. Cream separators will be manufactured.

The Hamilton Mfg. Co., Two Rivers, Wis., manufacturer of printers' supplies, will erect an addition which will add 65,000 sq. ft. of floor space to the present plant.

WEST OF THE MISSISSIPPI

The Union Motor Co., 114 Brady St., Davenport, Iowa, is erecting a new garage at Third and Warren Sts.

Hirsch & Linderman, Kurzok Bldg., McGregor, Iowa, are planning the construction of a brick garage on B. St.

The Villisca Retinning & Mfg. Co., Villisca, Iowa, is planning to erect a factory.

The Minneapolis Threshing Machine Co., Hopkins, Minn., will erect a one-story addition, 110x250 ft., to its factory. Paul Swenson is supt.

P. J. Petre & Son, Long Prairie, Minn., are constructing a cement block garage.

The contract for the construction of a roundhouse for the Chicago, St. Paul, Minneapolis & Omaha Ry. Co., at Minneapolis, Minn., has been awarded. The estimated cost is $50,000. Charles Johnson, St. Paul, Minn., is ch. engr.

Cornelia L. Jones and Carrie F. Jones, Omaha, Neb., will erect a two-story brick garage, 60x122 ft., at 25 and Farnam Sts. The estimated cost is $30,000.

R. A. De Mars, St. Thomas, N. D., is erecting a one-story steel garage at Main St. and Hager Ave.

Henry Senz, Terry, Mont., has awarded the contract for the construction of a 40x60 ft. one-story reinforced concrete garage.

W. C. Bryant, Carthage, Mo., is constructing a brick garage, 50x200, at 505 Main St., which is expected to be completed about July 1.

The garage of the Phillips Automobile Co., 5031 Delmar St., St. Louis, Mo., was burned, June 14. Loss, $12,000.

The Ford Motor Co., Detroit, Mich., has secured a site at Forest Park Blvd., St. Louis, Mo., and will erect an assembling plant. The estimated cost is $200,000.

The Volt Ampere Co., San Antonio, Tex., recently incorporated with a capital of $10,000, is establishing a plant for the manufacture of electrical appliances. The incorporators are: W. G. Rolaff, J. O. Luthy, and Yale Hicks.

W. E. Nation, vice pres. of the Retailers' Assn., Oklahoma City, Okla., is planning to establish an automobile and motor truck factory, which will contain about 12,000 sq. ft. of floor space. The estimated cost is $50,000.

Swanda Bros., 324-7 West First St., Oklahoma City, Okla., manufacturers of sheet metal, are planning to increase their capital from $25,000 to $50,000, for the purpose of constructing a large silo factory.

W. W. Watson, Denver, Colo., has secured a permit to erect a two story garage, 138x127 ft., at Colfax and Lincoln Sts. The estimated cost is $30,000.

The roundhouse of the Colorado & Southern R. R. at Leadville, Colo., was destroyed by fire, June 10. Loss, $15,000.

WESTERN STATES.

The Kent-Marvin Co., Bellingham, Wash., machinist and ship supply dealer, has acquired a site on the water front and will erect a new and larger plant. It will consist of a machine shop and a warehouse.

The city council of Seattle, Wash., has authorized the construction of a municipal garage. The estimated cost is $3,500.

Wiggins Bros., Los Angeles, Calif., have secured a site at Ave. 20, and North Broadway, and after removing the present building will construct a garage, 55x160 ft.

Haas, Baruch & Co., Los Angeles, Calif., will soon begin the erection of a commercial garage and repair plant on Rose St., near Stephenson Ave., Los Angeles. Morgan, Walls & Morgan, Story Bldg., Los Angeles, are the archs.

Ralph C. Hamlin, Los Angeles, Calif., will erect a commercial garage and machine shop on Flower St., Los Angeles. J. C. Austin and W. C. Pennell, Wright & Callender Bldg., Los Angeles, are the archs.

The Union Motor Truck Co., Sunnyvale, Calif., recently incorporated, is planning the erection of a factory for the manufacture of motor trucks. C. Y. Williamson is pres., and Ernest Horstman, vice-pres.

CANADA.

The Wray Water Pump Co., New Hamburg, Ont., is contemplating the establishment of a new plant.

The plant of the Sorel Steel Works, Sorel, Que., which was recently destroyed by fire, will be rebuilt.

The St. Lawrence Saw & Steel Works, Sorel, Que., will have plans prepared for the construction of a plant to replace the one recently destroyed by fire.

The Hupp Motor Car Co., Windsor, Ont., will erect an addition to its plant and install new machinery. The estimated cost is $15,000.

NEW INCORPORATIONS

METAL WORKING

The Walden Appliance Co., Kittery, Maine; machinery and appliances of all kinds. Capital $100,000. Incorporators: C. D. Burrage, Needham, Mass., and H. Mitchell.

International Stamp & Ticket Machine Co., Kittery, Maine; machines. Capital, $400,000. Incorporators: Horace Mitchell, and C. E. Smothers, Kittery.

Occidental Steel Co., Portland, Maine; iron, steel, manganese, coke, etc. Capital, $1,000,000. Pres., B. Smith; treas., F. H. MacRobert, New York, N. Y.

The Torsion Nut-Lock & Washer Co., Boston, Mass.; locks, bolts, washers, etc. Capital $50,000. Incorporator: J. A. Harris, Boston.

The Humphreysville Mfg. Co., Seymour, Conn.; capital, $50,000; metal goods of various kinds. Incorporators: H. P. Baldwin, P. F. Boies and H. G. Pheurer.

The Specialty Mfg. Co., Waterbury, Conn.; capital, $25,000; machinery. Incorporators: Alfred L. Schwartz and Clark A. Lewis of Waterbury, and C. T. Gray of Southbury.

Standard Meter Co., Brooklyn, N. Y.; water meters, etc. Capital, $400,000. Incorporators: J. A. Ross, 87 Front St., John Hobran, Jr., 358 Fifth St., and R. J. Doyle, 135 Broadway, New York.

Electric City Specialty Co., Buffalo, N. Y.; metal stampings and wire goods. Capital, $25,000. Incorporators: Joseph E. Stark, Ida E. Stark, 592 Swan St., and John H. Baer, 170 Landon St., Buffalo.

Stewart Motor Corporation, Buffalo, N. Y.; motor vehicles. Capital $250,000. Incorporators: C. J. Bork, B. L. Fischer, and W. F. Strasmer, Buffalo.

The Hoffman-Allan Co., Buffalo, N. Y.; machinery. Capital $500,000. Incorporators: W. M. Hoffman and F. B. Allan, G. R. Copping, Toronto, Ont.

McCordy Casting Machine Co., Fabius, N. Y.; machinery and metals. Capital, $25,000. Incorporators: C. A. McCordy, J. A. McDonnell, and E. L. Vezina, Syracuse.

Brooklyn Water Heater Co., Manhattan, N. Y.; gas water heaters. Capital, $200,000. Incorporators: R. R. James, H. W. Groesbeck, Brooklyn, and F. Sauer, Jersey City, N. J.

The Knickerbocker Commercial Vehicle Co., Manhattan, N.Y.; capital $300,000; commercial vehicles. Incorporators: E. A. Dillenbeck, 107 West 87 St., C. B. Williams, and E. A. Smith.

The Metal Specialties Co., Camden, N. J.; incandescent and kerosene lamps. Capital, $12,500. Incorporators: Henry N. Kerr, William T. Estberg, and Henry J. Kingstseh.

Aero Fire Alarm Co., Jersey City, N. J.; automatic fire alarms, signal devices. Capital, $100,000. Incorporators: L. McKee, C. A. Hand, and W. H. Brearley, Jersey City.

Decker Manufacturing Co., Newark, N. J.; appliances for generating heat Capital, $100,000. Incorporators: H. M. Whitehouse, Brooklyn, N. Y., M. B. Rosewig, and E. E. Decker, Saybrook.

Gas Appliance Manufacturing Co., Newark, N. J.; fuel measuring, feeding and conditioning devices, etc. Capital, $100,000. Incorporators: P. Feurstein, 15 Clinton Street, Thomas G. Herrick, and Thomas J. Butler, 763 Broad Street, Newark, N. J.

The National Lettergraph Co., Baltimore, Md.; capital, $100,000; type-setting machines. Incorporators: Frederick H. Knapp, 1537 Friendsbury St.; James Piper and H. Bannister Hall, Jr.

The Hinnant-Rierson Co., Wilson, N. C.; capital, $25,000; machinery. Incorporators: S. B. Rierson, J. T. Hinnant and T. O. Hinnant.

The Goetz Mfg. Co. of Cleveland, Ohio; capital; $50,000; flexible conduits. Incorporators: Carl J. Hager, J. J. Waldvogel, and Walter E. Hamilton.

The Canfield Tank Line Co., Cleveland, Ohio; capital, $35,000; tank and freight cars. Incorporators: George R. Canfield, J. A. Jackson, and W. J. Renkel.

The Automatic Tile Machine Co., Cincinnati, Ohio; tile machinery. Capital $10,000. Incorporators: A. W. Koch, M. Friehmelt and William K. Achert.

The Fremont Furnace Co., Fremont, Ohio. Capital $50,000. Furnaces and accessories. Incorporators: T. C. Harris, J. H. Combs and W. I. Eberly.

The Indiana Machine & Wire Co., Indianapolis, Ind.; fence machines. Capital $30,000. Incorporators: G. F. Whittington, F. H. Irwin and M. F. Cox.

Ideal Motor Car Co., Indianapolis, Ind.; capital, $100,000; automobiles, etc. Incorporators: H. F. Campbell, H. C. Stutz, and W. F. Glickert.

Brown Portable Elevator Co., Chicago, Ill.; capital, $150,000; engines and machinery. Incorporators: Frank Hall Childs, Harwood Frost, and Geo. W. Clark.

Jones Electric Starter Co., Chicago, Ill.; capital, $10,000; electric starters. Incorporators: Charles H. Roth, Edward L. Jones, and Gustave A. Roth.

The National Car Coupler Co., Chicago, Ill.; railway supplies. Capital $300,000 Incorporators: C. R. Milford, J. P. O'Shaughnessy and W. B. Weston.

General Manufacturing

NEW ENGLAND

Fire on June 18 destroyed the woodworking mill of the Oakland Mfg. Co., at Gardiner, Maine. Loss, $20,000.

Fire at New Portland, Maine, June 17, destroyed the lumber mills of C. H. Bartlett and of the Castle Lumber Co. Loss, $45,000.

The Mattrass Rubber Co., Boston, Mass., manufacturer of rubber garments, has secured the Brigham Bldg., in Hudson, Mass., and will equip it for the manufacture of its product.

The Forbes Lithographing Plant, Chelsea, Mass., has awarded a contract for the construction of a new factory. It will be three stories high, 45x100 ft., and will cost $60,000. W. S. Timmis, Marbridge Bldg., New York, N. Y., is the consult. engr.

Plans are being prepared for the construction of a one-story dye house, 60x30 ft., to be erected for the Bradford Durfee Textile School, Fall River, Mass. George P. Gilmore, 84 North Main St., is the arch.

The Southern Massachusetts Power Co., of Fall River, Mass., will install a new generator at its plant, to cost $200,000.

The bottling house and storage shed of the Old Colony Breweries Co., Fall River, Mass., were damaged by fire, June 12. Loss, $20,000, partly covered by insurance.

The Williams Shoe Co., Holliston, Mass., has awarded the contract for the erection of an addition to its factory. A. B. Nichols, of Holliston, Mass., is the architect.

The Mount Holyoke Tissue Mills, Holyoke, Mass., has awarded the general contract for the erection of an addition to its factory. The new building will be on Winter St., and will be of heavy mill construction, 80x108 ft., four stories high.

Bids have been received by C. W. Praray, arch., Times Bldg., New Bedford, Mass., for the construc- of a new mill for Green & Daniels Co., manufacturer of thread and yarns, and contracts will soon be awarded. The structure will be 70x150 ft., three stories high, and will cost $35,000.

The plant of the American Camphor Refining Co., South Boston, Mass., was damaged by fire, June 15. Loss, about $4,000.

The city of West Brookfield, Mass., contemplates the installation of a new water system to include a new reservoir, pumping station, and mains, to cost $45,000.

Fire on June 18 destroyed the mill of the Massachusetts Talc Co., at Zoar, Mass. Loss, $20,000.

The plant of the W. B. Mfg. Co., manufacturer of pants, Providence, R. I., was recently destroyed by fire at a loss of $100,000.

The A. H. Larietes & Co., Andover, Conn., is erecting a two-story factory in Shelton, Conn., to be used for the manufacture of baskets. The plant will be 40x90 ft., and will be operated by electricity.

Fire caused $5,000 loss to the plant of the Stony Creek Red Granite Co., Branford, Conn., destroying the stone-shed, two engine houses, a blacksmith-shop and all machinery. William Angus, Hartford, Conn., is pres.

The Max Pollock Thread Mill, Conantville, Willimantic, Conn., will erect a three-story addition, 50x104 ft., to its plant which will double the present capacity.

The Board of Contract and Supply, Hartford, Conn., will receive bids until July 9, for the equipment of a new pumping station to be erected on Keney Lane, for pumping out the East Side intercepting sewer. Roscoe N. Clark is city engr.

The planing mill of the Gustav Lowenthal Co., Middletown, Conn., was destroyed by fire on June 8. The estimated loss is $10,000.

The Wilcox & White Co., manufacturer of organs, Meriden, Conn., has awarded a contract for a four-story brick addition to its plant. It will be 40x110 ft., of heavy mill construction.

The Forsyth Dyeing Co., New Haven, Conn., is erecting a factory on Whalley Ave. It will be 249 x70 ft., two stories high, of brick, mill constructio.

MIDDLE ATLANTIC

Plans are being prepared by C. Makepeace & Co., Providence, R. I., for a four-story mill, 50x300 ft., and a 12-story dye-house, 58x83 ft., for the Chalmers Mill Co., at Amsterdam, N. Y.

The plant of the Allen-Bailey Tag Co., Dansville, N. Y., was damaged by fire, June 17.

The National Desk Co., Herkimer, N. Y., is constructing an addition to its present plant, 68x40 ft., two stories high.

Steinway & Sons, piano manufacturers, 109 East 14th St., New York, N. Y., have awarded the contract for the construction of a new factory at their plant in Steinway, N. Y. It will be four stories high, 67x 143 ft., and will cost $65,000. W. K. Benedict, 113 Broadway, New York, N. Y., is the arch.

The Consolidated Gas Co., 124 East 15th St., New York, N. Y., has awarded the contract for the construction of a new repair shop, 201 x 107 ft. The cost is $400,000. W. C. Morris, 124 East 15th St., is the Engr.-in-charge.

The Hartman Embroidery Works, Garfield, N. J., is receiving bids for the construction of a new embroidery mill. It will be two stories high, 49x109 ft., and will cost $15,000. Joseph De Rose, Paterson, N. J., is the arch.

Fire, on June 11, destroyed a part of Waters & Osborne's planing mill, at Red Bank, N. J. The estimated loss is $4,000.

The Dilworth Paper Co., New Castle, Penn., will erect a factory to manufacture paper bags. Estimated cost, $25,000.

The Class & Nachod Brewery, 1729 Mervine St., Philadelphia, Penn., will erect a cooper, bottling and engine house to cost $50,000.

Bids are being received by Sauer & Hahn, archs., 1112 Chestnut St., Philadelphia, Penn., for the construction of a factory for the Gregg Carriage Co., 1930 Arch St. It will be four stories high, 40x147 ft., and will cost $45,000. Noted May 16.

The dyeing establishment of the Roxborough Mills Co., Walnut Lane and Pechin St., Philadelphia, Penn., was damaged by fire, June 18. Loss, $30,000.

The carriage factory of F. R. Himmelberger, West Reading, Penn., was destroyed by fire, June 16. Loss, $125,000.

The Wernersville Hosiery Mill, Wernersville, Penn., will erect a new brick mill, 38x70 ft., and also a dye house, 14x38 ft.

Plans are being prepared and bids will soon be received for the construction of a five-story factory for Miller & Graham, Baltimore, Md., manufacturers of paint.

SOUTHERN STATES

The Chesapeake Knitting Mills will erect a brick and iron building, of fireproof construction, at Berkley, Va.

Robert Bullard, Sealston, Va., contemplates rebuilding his grist mill recently destroyed by fire.

E. T. Oliver, Raleigh, N. C., is president of a new company with $25,000 capital which will establish an ice-plant at Durham, N. C.

A $50,000 cotton oil mill will be erected at Elizabeth City, N. C. Address W. J. Woodley.

The Robeson Tobacco Warehouse Co., Fairmount, N. C., will receive bids July 1 to erect a tobacco factory, 65x235 ft.; cost $6000.

The Kannapolis Mill Co., Kannapolis, N. C., will erect a four-story bleachery.

The Ledbetter Mfg. Co., Rockingham, N. C., will erect a two-story building 75x150 ft. Contract has been awarded. Noted May 22.

The Mutual Canning Co., Wilmington, N. C., will install a plant to manufacture baskets, crates and boxes.

J. T. Shuler, Aiken, S. C., will enlarge his cotton-seed-oil plant.

Fire in the seed-house of the Southern Cotton Oil Co., Gadsden and Green Sts., Columbus, S. C., destroyed machinery valued at $10,000.

The Stokes Canning Co., will erect a plant at Chester, S. C.

The Mutual Ice Co., Florence, S. C., will establish an ice plant.

The Carolina Cotton Mill will expend $50,000 for a new addition to its mill at Greenville, S. C.

The Farmers' Gin Co., Greelyville, S. C., will erect a 22x32 ft. building, and install machinery costing $2500.

The Spain & Cass Syenite Co., Rion, S. C., will erect a plant at Mount Airy, N. C., to manufacture granite.

The Southern Cotton Oil Co., Spartanburg, S. C., will enlarge its cottonseed-oil mill. Additional machinery will be installed

The Atlanta Brewing & Ice Co., Atlanta, Ga., will erect a two-story building, 75x90 ft.

The Crystal Springs Bleachery Co., Chickamauga, Ga., will build a large cotton mill.

The sawmill of the Henderson Lumber Co., near Ocilla, Ga., was damaged by fire, June 10. Loss, $3,000.

The Farmers' Ginning Co., Tifton, Ga., will erect a 24x44 ft. ginnery and install four 70-saw gins and two English gins.

The Valdosta Gas Co., Valdosta, Ga., contemplates improving its gas plant. Cost, $50,000.

The De Soto Ice & Cold Storage Co., Arcadia, Fla., will build an ice and cold-storage plant.

The Hernando Farm Co., Brooksville, Fla., M. L. Dawson, pres., will build an evaporating plant to manufacture syrup.

The Largo Consolidated Canneries, W. W. Ulmer, pres., Largo, Fla., will erect a plant, 80x100 ft., of mill construction.

A. J. Aderhold, Birmingham, Ala., will erect a two-story flour mill 100x160 ft.

The Southern Coupon Co., Birmingham, Ala., has awarded the contract to M. C. Banks, to erect a one-story fireproof building 100x140 ft. Cost, $10,000.

A. J. Aderhold, Birmingham, Ala., is establishing a flour mill.

The Perdido Shingle Co., Bay Minette, Ala., will rebuild its shingle mill. Noted May 29.

The Pioneer Electric Light Co. will establish an ice, electric-light and gas plant at Eufaula, Ala.

Kirk & McConnell, Latham, Ala., will erect a sawmill costing $25,000.

A turpentine distillery is being built on Three-Mile Creek, Mobile, Ala., by a Mr. J. A. Schofield.

I. C. Loveless, Moundville, Ala., will establish a cement brick plant.

Robert Gamble, Jacksonville, Fla., contemplates establishing an ice plant at Montgomery, Ala.

J. D. Wyker, W. R. Spight and others will erect a cottonseed-oil mill at New Decatur, Ala.

The Prattville Cotton Mills Co., Prattville, Ala., will build a 48x58 ft. addition, of brick, with concrete floors. The contract has been awarded to Algernon Blair, Montgomery. Noted May 22.

L. G. Jones and T. S. Plowman, Talladega, Ala., will erect a cotton compress.

Pierce & Norris, Hattiesburg, Miss., will erect a shuttle plant factory at Newton, Miss.

C. H. Hummel, Hammond, La., will erect a fruit pre-cooling plant.

The Seager Engine Works, New Orleans, La., will erect a pumping-station of 65,000,000 gals. daily capacity. The Allen Engineering Co., Chicago, Ill., is the engr.

The bag factory of M. & P. Reilly, 327 Girod St., New Orleans, La., was damaged by fire, June 11. Loss, $20,000.

The American Creosoting Works, New Orleans, La., will establish a creosoting plant at Louisville, Miss.

Wetherbee & White will erect a sawmill at Shubuta, Miss.

Joseph C. Eggert, Cincinnati, Ohio, and associates will erect a distillery, 300x900 ft., at Westwego, La.

J. M. Bushart, Henry, Tenn., will erect a tobacco factory to cost about $25,000.

The Tennessee Timber, Coal & Iron Co., Harriman, Tenn., will erect a large sawmill near Nemo, Tenn.

The Braylesville Mills, Limestone, Tenn., contemplates installing additional machinery.

The Cumberland Heading Co., Livingston, Tenn., has been organized for the manufacture of tight barrel headings. The concern has secured a building and will install machinery.

The Chickasaw Cooperage Co. will build a stave and heating plant at Memphis, Tenn.

The Gilliland Lumber Co., Nashville, Tenn., contemplates building a sawmill, at Clarksville, Tenn.

The plant of the F. & O. Cedar Works, Nashville, Tenn., was destroyed by fire June 13. Loss, $20,000. George M. Stieglar is pres.

M. Bushart will rebuild his tobacco factory, recently destroyed by fire at Ranton, Tenn.

Brown & Jordan, White Bluff, Tenn., have announced plans for the installation of a mill for the manufacture of cooperage material.

The People's Loose Leaf Tobacco Warehouse, Carlisle, Ky., has announced plans for the erection of a redrying plant.

Allen Williams, Eddyville, Ky., has announced plans for the erection of a grain elevator. Plans for equipment are being prepared.

The Racine Lumber Co., Racine, Wis., will install a planing-mill at Eddyville, Ky.

Vogel Bros. & Co., Louisville, Ky., are contemplating the erection of an addition to their shoe factory at Eighth and Market Sts.

The Wedgerite Powder Co. has been incorporated in Louisville, with $300,000 capital stock, and has plans for the erection of a factory to manufacture a patented explosive. J. C. Armstrong is pres.

The plant of the Louisville Cottonseed Products Co., Floyd and H. Sts., Louisville, Ky., was destroyed by fire, June 13. Loss, $35,000.

The Booker Box Co., Louisville, Ky., will install wood-working machinery.

The Louisville Artificial Limb Mfg. Co., Louisville, Ky., has been incorporated and is equipping a wood working shop at 429 West Jefferson St. Motor-driven machinery will be used. Address John A. McKnight.

The Booker Box Co., Louisville, Ky., will require additional woodworking machinery.

The Modern Construction Co. has been incorporated in Louisville, Ky., with $10,000 capital stock for the manufacture of tiles. A plant will be erected. F. C. Goodwin, 1157 South First St., Louisville, is interested.

The American Tobacco Co., Lexington, Ky., will erect a redrying plant. The machinery will cost $25,000.

A. P. Gooding, Jr., contemplates erecting a canning and preserving factory at Lexington, Ky.

The Marion Electric Light & Ice Co., Marion, Ky., will receive bids on the installation of additional machinery in its plant. S. M. Jenkins is pres.

The Hardy Buggy Co., Paducah, Ky., will rebuild its plant recently destroyed by fire.

The Currier Lumber Corporation, Glamorgan, Va., contemplates the erection of lumber and stave mills at Whitesburg, Ky.

MIDDLE WEST

The Portage Rubber Co., Barberton, Ohio, will erect a two-story factory, 30x96 ft. Cost $8500.

The City Ice Co., Cleveland, Ohio, will erect a new ice plant. William Norville is pres.

The General Baking Co., Cleveland, Ohio, will build two new bakeries, one 124x50 ft. and the other 130x45 ft.

A new carriage manufacturing factory, 120x50 ft., three stories, will be erected by C. F. Hangeris, 6420 Carnegie Ave., Cleveland, Ohio.

The Bell Telephone Co., Cleveland, Ohio, will expend $18,000 for new telephone exchange equipment.

The Herschede Hall Clock Co., Cincinnati, Ohio, will erect a one-story factory at Essex Place and McMillan St., to cost $40,000.

The Burkett Agricultural Works Co., Columbus, Ohio, will erect a two-story factory, 30x50 ft. Cost, $3000.

The Rowe & Giles Lumber Co., Chagrin Falls, Ohio, is in the market for woodworking machinery for its lumber mill.

The C. & E. Shoe Co. is rebuilding its plant at Columbus, Ohio, which was destroyed by fire, and is also erecting a new plant at Delaware, Ohio.

The Ottawa Co., Ottawa, Ohio, will erect a new grist mill. P. M. Aurer is mgr.

Bids for the construction of an addition to the filtration plant of Sandusky, Ohio, will be received on July 10. Estimated cost, $10,000.

The Toledo Cooker Co., Toledo, Ohio, will erect a factory addition to cost $10,000.

The city clerk of Columbus, Ind., will receive bids July 2, for the construction of a mechanical water filter.

The Goodyear Tire & Rubber Co., Indianapolis, Ind., will erect a five-story building at Capitol Ave. and Walnut St. Estimated cost, $50,000.

The Flushing Canning Co., Flushing, Mich., has awarded the contract for the construction of a new plant consisting of three buildings, each 44x84 ft. Cost, $20,000.

Fire destroyed the plant of the Ludington Woodenware Co., Ludington, Mich. Loss, $15,000.

The flour mill of the Krueger-Lachman Co., Neenah, Wis., was destroyed by fire, June 11. Loss, $10,000, covered by insurance.

The Piqua Handle & Mfg. Co., Thompsonville, Mich., is planning to spend $20,000 in enlarging and improving its plant.

The plant of the Prest-O-Lite Co., 1912 South 52nd Ave., Chicago, Ill., was damaged by fire, June 17. Loss, $15,000.

The Kohler Dye & Specialty Co., Chicago, Ill., has awarded the contract to P. F. Miller for a factory addition. Cost, $10,000. Noted June 5.

The Acme Malting Co., Chicago, Ill., will build a malt house at 1800 Number 45th St. Cost $5000.

The Chicago & Riverdale Lumber Co., Chicago, Ill., will build a one-story brick planing mill.

C. N. Lindley, Appleton, Wis., will erect a three story laundry, 30x122 ft.

The Marinette & Green Bay Mfg. Co., Marinette, Wis., has let the contract for the new excelsior factory to the Harmon Construction Co., Antigo, at $11,349.

The factory of the H. A. Schwartzburg Box Co., 517 North Ave., Milwaukee, Wis., was damaged by fire, June 12. Loss, $3,500, covered by insurance.

The Lorenz Bros.' Macaroni Co., Milwaukee, Wis., will erect a three-story factory, 60x120 ft. Noted May 16.

The Milwaukee Lace Paper Co., Milwaukee, Wis., will erect a five-story factory, 72x137 ft.

The Bergstrom Paper Co., Neenah, Wis., will erect a three-story paper mill 250x250 ft.

Bids were received by P. A. Lien, secy., of the Stanley Dairy & Warehouse Co., June 15, for a one-story building at Stanley, Wis.

WEST OF MISSISSIPPI

The Eveleth Steam Laundry, owned by Henry Holland, Eveleth, Minn., was damaged by fire, June 13.

The Omaha Furniture Co., Omaha, Neb., has started the erection of its plant at Ralston. Noted June 13.

The Eggers-O'Flyng Paper Box Mfg. Co., Omaha, Neb., has obtained a permit to erect a factory at 1413–15–17 Leavenworth St. The estimated cost is $40,000.

An election was held in Cutbank, Mont., June 17, on the proposition of installing a water-works system.

The city of Bethany, Mo., has voted bonds for $25,000 for the construction of an electric light plant and water-works. J. B. McClure is city clerk.

M. B. Hamilton & Co., 309-11 Virginia Ave., Joplin, Mo., manufacturers of gloves, have awarded the contract for the construction of a new factory on Pennsylvania Ave. It will be a two-story structure, 50x120 ft. The estimated cost is $10,000. M. B. Hamilton is pres.

The American Mfg. Co., St. Louis, Mo. will construct an addition to its plant for the manufacture of cordage and jute-twine.

The sawmill of the Arkansas Lumber Co., near Warren, Ark., was destroyed by fire, June 9. Loss, $100,000, covered by insurance.

T. Manning and associates, Womble, Ark., are planning to construct a chair factory. The estimated cost is $25,000.

Clyde L. Wright and associates are erecting a cotton compress at Elgin, Tex.

The city of Madisonville, Tex., will vote, July 15, on bonds for $16,000 for the purpose of constructing a water-works.

The city of Oak Creek, Colo., will install a water system to cost $30,000. Noted June 13.

WESTERN STATES

The city of Burlington, Idaho, has voted bonds for the installation of a new water-works system. The estimated cost is $21,000. Noted June 6.

The city of Burlington, Idaho, is contemplating making numerous improvements in its electric light and power system.

The city of Kamiah, Idaho will soon hold a special election to vote bonds for $12,000 for the purpose of installing a municipal water system.

The Pacific Power & Light Co., Lewiston, Idaho, is planning to rebuild its gas plant at Lewiston. The estimated cost is $50,000.

The Globe Cement & Construction Co., Globe, Ariz., will soon begin the erection of a plant for the manufacture of cement blocks and cement brick at Miami, Ariz. A steam curing kiln will be installed.

The Clements sawmill, near Lyle, Wash., was burned, June 10. Loss, $7,500.

The Tacoma Lumber & Shingle Co., Tacoma, Wash., will soon begin the erection of a new lumbering plant on Front St., between Union and Puget Sound, Tacoma.

The planing mill of the St. Paul & Tacoma Lumber Co., Tacoma, Wash., which was recently destroyed by fire, will be rebuilt. E. G. Griggs is pres. Noted June 20

The drying sheds and engine house of the Toppenish Brick & Tile Co., Toppenish, Wash., were destroyed by fire, June 3. Loss, $7000, insurance, $2500.

The Forest Grove Fruit Growers' & Cannery Assn., Forest Grove, Ore., recently incorporated, will erect a fruit canning plant. H. C. Atwell is pres., and A. E. Hait is sec.

The National Apple Co., Hood River, Ore., has started the erection of its apple cold storage plant. The building will be 80x100, ft. four stories high, with an addition of 38x50 ft. for machinery and additional room for offices. The plant will provide storage capacity for 125,000 boxes of apples. C. H. Sproat is mgr.

William Zottman, Nehalem, Ore., will erect a steam laundry plant at Nehalem.

Joseph Cunha, Pendleton, Ore., has purhcased the old Henrietta flouring mill plant at Echo, Ore. The plant will be considerably improved, additional equipment will be installed and a large concrete warehouse will be erected.

The city of Colton, Calif., will soon hold a bond election to vote on bonds for $6,000 for the purpose of improving its water system.

The lumber mill at Hardy Creek, near Ukiah, Calif., owned by the New York & Pennsylvania Redwood Co., was burned, June 9. Loss, $200,000, with no insurance.

The Pacific Fruit Cooling & Vaporizing Co., Lodi, Calif., is planning to install an ice making plant. It will have a daily capacity of 50 tons.

The Los Angeles Gas & Electric Co., Los Angeles, Calif., has taken out a permit to erect a new engine and boiler room at 572 Factory Pl. Estimated cost, $20,000.

The El Segundo Canning Co., Los Angeles, Calif., is planning the erection of a plant at Los Angeles. The estimated cost is $200,000.

The slaughter house of Miller & Lux, Los Banos, Calif., was destroyed by fire with a loss of $40,000.

The city of Pasadena, Calif., will soon hold a bond election to vote on issuing bonds for $1,250,000, for the purpose of installing a new water-works system.

The Lubricating Products Co., San Francisco, Calif., recently incorporated, has acquired a site at Ravenswood, near Palo Alto, Calif., and will erect a plant for the manufacture of all kinds of high-grade lubricating oils and composition. Henry J. Crocker and A. Wessitch, San Francisco, are interested.

The Pomona Valley Ice Co., Pomona, Calif., is planning to build a two story brick addition to its ice plant. The estimated cost is $30,000. Robert Orr, State Bank Bldg., is the arch.

The Chuckawalla & Palo Verde Irrigation Co., Palo Verde, Calif., is planning the installation of a large pumping plant on the Colorado River, to supply an irrigation system.

W. D. Bethel, Redlands, Calif., will install a pumping plant on his ranch near Thermal, Calif.

The Munger Laundry Co., San Diego, Calif., has been incorporated with a capital stock of $100,000, for the purpose of erecting and operating a steam laundry at San Diego. George M. Munger is pres.

CANADA

The Canada Cement Co., Montreal, Que., is planning the erection of a plant. The estimated cost is $10,000,000.

The Ritchie Cut Stone Co., Hamilton, Ont., will equip a new stone cutting plant. The estimated cost is $25,000.

The planing mill of the Jones Hardware Co., Lindsay, Ont., was damaged by fire, June 13. Loss, $3,000, partly covered by insurance.

The St. Lawrence Starch Co. is planning to erect a five-story factory, 480x100 ft., at Port Credit, Ont. The estimated cost is $150,000.

The Gutta Percha Rubber Co., Toronto, Ont., has obtained a permit to erect a two story factory between O'Hara and West Lodge Aves. The estimated cost is $12,000.

The city of Windsor, Ont., is having plans prepared for the enlargement and improvement of its pumping station. New pumps and other equipment will be installed. W. A. Hanrahan is secy. of the water-works board.

The Alsip Brick & Supply Co., Winnipeg, Man., is contemplating the establishment of a brick manufacturing plant at Edmonton, Alta. The estimated cost is $100,000. W. P. Alsip, Winnipeg is pres.

Compressed Cork Co., Brooklyn, N. Y.; cork products. Capital, $100,000. Incorporators: Jose Torres, 120 Townsend Avenue, Staten Island, Jose Mundet, 311 West 97th Street, New York, and Jacques L. Woldenberg, 2209 Broadway, New York.

H. W. Corbush, Inc., Manhattan, N. Y.; shoes. Capital, $20,000. Incorporators: H. W. Forbush, 12 Peck Slip, H. A. Forbush, 125 Claremont Avenue, New York and U. J. Graham, Elizabeth, N. J.

The Sanitary Holder Manufacturing Co., Manhattan, N. Y.; dentist rubber dam holder. Capital, $50,000. Incorporators: V. S. Vail, C. A. Hallet, Riverhead, and H. M. Howell, Southampton.

Ideal Picture & Novelty Mfg. Co., Manhattan, N. Y.; capital $6,000; pictures. Incorporators: F. A. Miller, B. Zolty, and L. Pollock.

Hutchinson Insecticide Co., Manhattan, N. Y.; capital $150,000; insecticides. Incorporators: L. A. Ruse, R. H. Hutchinson, and C. T. Dixon, New York City.

Ernest Oeser & Co., Manhattan, N. Y.; capital $100,000; photographic mounts. Incorporators: M. Traub, I. Nacht, and M. A. Hills.

Arthur Boomhower Corporation, Manhattan, N. Y.; rugs, carpets, etc. Capital, $150,000. Incorporators: A. Boomhower, M. V. Boomhower, and A. H. Littlefield, New York City.

The Nahon Co., Manhattan, N. Y.; furniture. Capital, $150,000. Incorporators: Edward E. Nahon, 147th Street and Convent Avenue, New York City, and Henry J. Nahon, William H. Gay, Grand Rapids, Mich.

Liberty Rubber Co., Jersey City, N. J.; rubber tires, rubber goods, etc. Capital, $50,000. Incorporators: B. S. Mantz, L. H. Gunther, and J. R. Turner, 15 Exchange Pl.

The Newbold Mfg. Co., Newark, N. J.; chemicals. Capital $250,000. Incorporators: C. A. Woodruff, E. T. Williamson and J. B. Potter.

Mitchell Watchung Silk Mfg. Co., Plainfield, N. J.; silk and other textile fabrics. Capital $150,000. Incorporators: T. J. Mitchell, New York City; E. M. Laing and W. R. Codington.

Witherspoon Bros. Shoe Mfg. Co., Sumter, S. C.; capital, $35,000; shoes. Pres., E. L. Witherspoon, Vice-Pres., H. L. Witherspoon, Sec.-Treas., J. S. Hodges.

Bond Piano Company, Ft. Wayne, Ind.; pianos. Capital, $100,000. Incorporators: J. H. Bass, A. S. Bond, and H. W. Bond.

Steger & Sons Piano Mfg. Co., Illinois, Ind.; capital, $160,000; pianos. Incorporators: J. V. Steger, G. F. Steger and C. G. Steger.

The Petersburg Cooperage Co., Petersburg, Ind.; capital $9,000; slack cooperage and hardwood lumber. Incorporators: E. B. Morgan, J. H. Kearns, and M. O. Burchett.

Duluth Clay Products Co., Duluth, Minn. Capital $100,000. Clay products. Incorporators: F. W. Young, W. B. Dunlop and T. J. Walsh.

Business Items

Wells Brothers Co., Greenfield, Mass., have opened a store in Boston at 163 Oliver St., in which a complete stock of screw-cutting tools will be carried. John E. Chipman is the manager of the new store.

Fraser and Gray have established at 30 Church St., New York City, a general contracting business in the installation or overhauling of machinery of all kinds, particularly of power and manufacturing plants.

The Crane Puller Co., Allston, Mass., manufacturer of crane pullers for pulling gears, fly wheels, etc., off shafts, owing to the need for increased facilities have moved into a new plant at 54 Lake Street, Arlington, Mass., which will be their address in the future.

Trade Catalogs

The Butler Chuck Co., Greenfield, Mass. Pamphlet, Drill Chuck.

International Oxygen Co., New York City. Bulletins, welding apparatus.

Philadelphia Gear Works, Philadelphia, Pa. Catalog, gears. Illustrated, eighty 6x9 in. pages.

Lea Equipment Co., Philadelphia, Pa. Bulletin 8, cold saws. Illustrated, nine 8½x11 in. pages.

Yale & Towne Mfg. Co., New York City. Catalog 12D, hoists. Illustrated, ninety-five 6x9 in. pages.

Hyatt Roller Bearing Co., Newark, N. J. Catalog, Roller bearings. Illustrated, fifty-two 9x12 in. pages.

Rochester Boring Machine Co., Rochester, N. Y. Catalog, boring machines. Illustrated, twenty 8½x 11 in. pages.

The Hess-Bright Mfg. Co., Philadelphia, Pa. Catalog, ball-bearing hangers. Illustrated, thirty-two 6x9 in. pages.

The National-Acme Mfg. Co., Cleveland, Ohio Booklet. Screw machine products. Illustrated, thirty 5x7 in. pages.

P. G. H. Bennet & Co., Boston, Mass. Pamphlet, punch, shear and rod cutting machines. Illustrated, eleven 4½x7 in. pages.

The American Tool Works Co., Cincinnati, O. Bulletin, Lathes, planers, shapers, drillers. Illustrated, thirty 8½x11 in. pages.

Forthcoming Meetings

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Institute of Metals (formerly American Brass Founders Association) Annual Convention, Sept. 24, 25, 26, Hotel Iroquois, Buffalo, N. Y. W. W. Corse, Secretary, Buffalo, N. Y.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburgh, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland. Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

MEN WANTED

Canada

MACHINISTS, first class. Lathe, planer and vertical boring mill hands. In writing, state age, experience and wages expected. Box 454, American Machinist.

FOREMAN—Experienced in medium and heavy machining, must be first-class man. In writing give full particulars as to experience, and state salary expected. Box 508, Am. Mach.

JIG MAKERS AND OPERATORS—First class jig makers; also machine tool operators for tool room. Highest wages paid to the right men. Apply Russell Motor Car Co., West Toronto, Ont.

TOOLMAKERS—Two or three first class; jig, fixture and die work. State wages expected and when you could start work. Apply Ross Rifle Co., Quebec, Canada.

DRAFTSMAN experienced in the design of wood working machinery. State age, particulars of past experience, salary required, etc. Good prospects with large Canadian concern. Box 473, Am. Mach.

Kentucky

FINAL INSPECTOR AND ALIGNER who has had experience on typewriter work to take charge of similar department. Must have been in charge of such work and be able to furnish the best of references All answers will be treated confidentially. State age, experience, salary and when available. Gifve ull particulars in first letter. Box 505, Am. Mach.

Massachusetts

TOOLMAKERS for punch and die work. Write Worcester Pressed Steel Company, Worcester, Mass.

MACHINIST to go on road demonstrating first-class vertical grinder. Excellent opportunity for right man. State age, experience and salary expected. D. F. S. Clark, 141 Milk St., Boston.

ASSEMBLING FOREMAN for concern manufacturing high grade small electrical apparatus in large quantities. Man must be good bench hand, energetic, used to fine interchangeable work, and familiar with piece work or premium system. P. O. Box 43, Springfield, Mass.

FOREMAN for department machining hard rubber and other insulating parts. Must be familiar with bench, lathe and drill work on similar material and used to quantity work of very accurate character. In your reply state age, nationality, former places and periods of employment, and salary desired. P. O. Box 43, Springfield, Mass.

FOREMAN—An old established, well-known New England concern is enlarging its department for making up-set machine screws, both rolled and cut thread, and wishes a competent foreman for same. None but experienced men need apply. Please state experience, references and salary required. All references strictly confidential. No references to present employers without permission. Box 452, American Machinist.

New Hampshire

TEACHER—A man with ability as a teacher to instruct classes in pattern making and foundry work in New Hampshire College. Address F. E. Cardullo, Durham, N. H.

New Jersey

DRAFTSMAN capable of taking charge of work on machine tools. Box 451, Amer. Mach.

New York

TOOL AND DIE MAKERS—Several first-class, accustomed to making moulds for die-castings, good salary and permanent. Box 497, Am. Mach.

OPERATOR—First-class horizontal boring machine operator on machine tool work; 39 cents per hour, permanent position and good opportunity for right man. State experience and references. Box 481, Am. Mach.

MECHANICAL ENGINEER—Unusual opportunity with option of investment for mechanical engineer, combining engineering knowledge with some executive and selling ability. Company located in Buffalo, N. Y., manufacturing and selling contractors' machinery and equipment, also specialties for steam, water, gas, oil, and air. Box 471, Am. Mach.

MACHINIST, by well known concern. First-class, thoroughly posted on up to date shop methods, to demonstrate and sell a standard line of goods to the iron and steel manufacturing plants. We have a good opening for a live wire in Ohio, Pittsburgh and New Jersey territories. Permanent position to right man. State age, experience and salary expected at start. Box 486.

SUPERINTENDENT AND FACTORY MANAGER for drop forge company in New England doing a general jobbing business and making a line of small tools. Applicants should be competent to make estimates, design dies, tools and fixtures and to introduce modern methods of production. Good opportunity for a thoroughly competent and up to date ambitious man. Past experience should be stated fully, also present position and salary expected. All replies will be treated strictly confidentially and no inquiries made from present employers without consent of applicant. Address X Y Z, Am. Mach.

Ohio

DIE AND JIG MAKERS—First-class, on high-grade telephone work; state experience and wages. American Automatic Telephone Co., Urbana, Ohio.

MACHINE TOOL SALESMAN, first class, wanted for New England territory; permanent position for the right man; none but experienced salesman considered. Box 408, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal pattern-makers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

DRAFTSMAN—A good man with no less than five years' experience in drawing office, on machine tools, rolling mill work, and heavy machinery in general. Box 484, Am. Mach.

INSTRUCTORS in mechanical engineering and in mechanical drawing at an Eastern institution. Applicants must be graduates of technical schools, preferably with one or two years' practical experience. Give full details of education, experience and salary expected. Box 489, Am. Mach.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Vermont

MACHINIST—An all-around good man on small machinery. A young man preferred. Matson Machine Co., Bethel, Vt.

FOREMAN OR SUPERINTENDENT—A good place for a good man. If you are just an ordinarily good foreman or superintendent, don't answer this advertisement. We cannot waste time and postage on men who do not meet the requirements clearly set forth below. The place—an established machine building plant of moderate size, but with a record of a sure, steady growth in business and reputation for many years. It has now reached a point where it needs organization of the highest type, in order that its superior product may be maintained under modern commercial manufacturing conditions. Being located in a small town, the plant has the disadvantages of isolation, with the compensating advantages of a permanent, highgrade working population. The man—We need a superintendent with the following qualifications: He must understand the requirements of fine workmanship. He must have high organizing ability. He must be able to get along with independent, permanent, skilled labor. He must be able to point to his present situation as evidence of his ability to fill the requirements outlined above. Box 498, Am. Mach.

Virginia

DRAFTSMAN, Experienced, on heavy bending rolls, punch and shear, and heavy machinery. State experience and salary expected. Covington Machine Company, Covington, Va.

Wisconsin

FOREMAN for machine crew of 20 men, gas engine work. Must be hustler and able to produce large quantity with modern equipment. Box 485, Am. Machinist.

MEN WANTED—Because of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works. For men above the average such positions offer splendid opportunities In addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary. One-third of our present employes have been with the management of this company from eight to twenty-six years. Address: "Factory Manager," The Thomas B. Jeffery Company, Kenosha, Wisconsin.

Foreign

MACHINE TOOL SALESMAN for Austria, speaking German and Bohemian, capable of demonstrating efficiency of modern machine tools. Give details of past experience, state references, nationality, age, salary, etc., in applying to Box 423, Am. Machinist.

Positions Wanted

Connecticut

SUPERINTENDENT—By energetic manufacturing superintendent, good organizer and executive, wide experience on rate setting and quantity production. Now employed. Box 444, Am. Ma

FOREMAN—Tool-room or similar responsible position by a young practical mechanic experienced on tool-making, manufacturing and inspection of small and medium size product. Box 478, Am. Mach.

Massachusetts

GENERAL FOREMAN—Thoroughly familiar with modern shop practice on medium and large work, expert mechanic, permanent position. References. Box 400, Am. Machinist.

GENERAL FOREMAN—Expert mechanic, thoroughly familiar with accurate interchangeable machine parts. Good executive. References, permanent position. Box 507, Am. Mach.

New Jersey

DESIGNER, twenty-seven, having good shop and drafting-room experience, technical graduate, wishes good position. Box 482, Am. Mach.

OPERATOR—Automatic and hand screw machine operator wishes position as machine-setter or operator where there is chance for advancement. Box 496, American Machinist.

OPERATOR—Automatic (B. & S.), first class, ten years' experience, high grade, accurate work, design own cams, etc., capable to take full charge, any locality. Box 488, Am. Mach.

TOOL DESIGNER with 15 years' experience desires change. Past 3 years chief tool designer with large concern having charge of 25 men. Age 33, technical education, good reasons for changing. Box 483, Am. Mahcinist.

MECHANICAL ENGINEER, technical graduate, 9 years' experience on machine design and building construction, wants position as designer, or assistant to consulting engineer, New York or vicinity. Box 495, Am. Machinist.

FOREMAN OR SUPERINTENDENT of small shop, by experienced man of 38. At present in charge of manufacturing small accurate instruments. Designer of automatic press tools and automatic safety stops. Install simple cost system. Box 472, Am. Machinist.

New York

MECHANICAL DRAFTSMAN — Various experience, wishes position. Box 494, Am. Machinist.

FOREMAN AND TOOL-SETTER, 20 years' experience, thoroughly understand working all kinds of metals. Best references. Box 504, Am. Machinist.

FOREMAN—30, practical mechanic and executive. Engines, electrical and general machinery, medium or heavy work. Understands Taylor system. Box 492, American Machinist.

MECHANICAL ENGINEER, college graduate, 2 years' shop experience, 4 years drafting automatic machinery; talks French, some English; desires position with reliable concern. Will go anywhere. Moderate salary. Box 502, Am. Machinist.

SUPERINTENDENT, with several years' experience on high grade machine work under the premium plan, seeks place as assistant to successful superintendent working on the bonus system. Engineering graduate, age 32, energetic. Box 464, Am. Mach.

PRODUCTION MAN, now employed, wants place to stimulate output and quality. Engineering training. Several years' experience in design and manufacture of high grade steam machinery. Can take charge of shop if desired. Box 465, Amer. Machinist.

MECHANICAL ENGINEER, skilled, 34, technical education, broad practical experience in shop, erection, and office. Competent to develop and superintend output of high grade automatic machinery and tools, is open for engagement. Box 503, Am.Ma.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

TOOL DESIGNER, 18 years' shop and office experience in automobile, automatic, arms and special machinery, thoroughly acquainted with rapid production. Last 5 years foreman and general foreman, wants position as chief draftsman or master mechanic. Box 506, Am. Mach.

WORKS MANAGER—Executive, broad experience in design and manufacture of high grade and automatic machinery, gas, gasolene, and steam engines, etc. Thoroughly familiar with modern shop methods, organization and economical production. Box, 499, Am. Mach.

SALES OR GENERAL MANAGER—Successful manager of sales and office with large machinery manufacturer, age 30, technical graduate, shop training, thorough experience in manufacturing and selling, desires executive position which will utilize his varied experience. Box 490, Am. Mach.

Pennsylvania

MACHINIST—Ten years' experience as a machinist. Electrical engineering graduate, one year and a half engineering experience. Box 480, Am. Mach.

MECHANICAL ENGINEER—Young, recently instructor at prominent university, desires position leading to increased responsibility. Box 500, Am. Mach.

YOUNG MAN, technical graduate, associated with an efficiency engineer, is looking for a permanent executive position. Am familiar with organization, costs, production, and general factory management. Box 479, Am. Mach.

DESIGNER—Executive position by experienced designer of practical and theoretical training and conversant with modern shop and business methods. Also accustomed to handling men. Highest references. Address R. P. D., Am. Mach.

EFFICIENCY EXPERT, three years with large manufacturing concern, wants to make a change. Would like to correspond with firms desiring better system and higher efficiency in their shops. Thoroughly practical ideas. Box 446, Am. Mach.

OFFICE MANAGER, now employed, desirous of making change. Able to take charge of stock, purchasing, order and cost departments. Ten years' experience. Thirty-two years of age and married. Box 457, American Machinist.

FOREMAN of assembling department, 10 years with present firm and making good, but would like to get with firm in Philadelphia manufacturing small interchangeable parts. Experienced in handling both men and girls, capable, competent and up to date. Can design own tools and fixtures, good systematizer, knowledge of piece work or premium system. Box 477, Am. Mach.

Rhode Island

WORKS MANAGER OR SUPERINTENDENT, 38, I have a proven record of efficiency. Desire large responsibilities that will absorb my extensive experience, energy, perseverance and ambition. I have trained capable assistants. I am thoroughly versed in modern simple office and shop systems that have reduced production costs in both wood and metal. Expert inventor, designer and draftsman. I will make good or pay; find a way or make one. Address "Engineer," Box 491, Am. Mach.

Wisconsin

SUPERINTENDENT, up-to-date and a hustler, many years on automatic machinery, expert on high class tool design and interchangeable manufacture, seeks position with progressive concern, East or West. Box 460, American Machinist.

GENERAL FOREMAN OR SUPERINTENDENT; thorough mechanic and producer; 10 years' experience and university education; production nearly doubled at last place. Wants position with medium sized plant in Middle West. A-1 references. Box 493, Am. Machinist.

FACTORY MANAGER—Superintendent, young man, at present in charge of shop employing 500, desires change. Take full supervision of plant, analyze conditions, organize, systematize, and introduce best methods in general. Graduate engineer. Box 501, Am. Mach.

Foreign

MECHANICAL ENGINEER—Foreign business, French mechanical engineer, 31, technical, designing, practical shop and office experience; thorough knowledge of technical and commercial English and French, speaks both languages fluently; handles all correspondence and technical matter in both languages dealing with machine tools, small tools and various appliances; used to American business methods, wishes to know of a concern able to take him on as their own agent for introducing new line in France. Good future prospects an important item. Maud. post. 126493, bureau 26, Paris.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

Address of firms doing high class custom tool, jig, and die work wanted. Wagner Electric Mfg. Co., St. Louis, Mo.

American Machinist sets, volumes, copies before 1908 wanted for cash by International Magazine Co., Elizabeth, N. J.

For Sale—I wish to dispose of my patents, just issued, on nut tapping machine. For particulars, address Carl Baerwalde, Cleveland, Ohio.

A great opportunity to obtain the right for the manufacture of a well-known patented tachometer. Communicate with Edward M. Meek, 165 Broadway, New York City.

For Sale—Machine shop in town of 5000 in New Jersey. Large plot of ground. Price $5500; cash required, $3500. Just adding a new line of work. Box 487, Am. Machinist.

Canadian company, with modern equipment, manufacturers of woodworking machinery, wish to acquire the Canadian right to manufacture one or two high grade wood tools. Box 448, Am. Ma.

Experimental apparatus or anything needing extra good machine shop work and oversight can be economically built at my new laboratory and shop. A. H. Emery, Stamford, Conn. Works at Glenbrook, Conn.

A good second hand universal milling machine, not particular as to the maker, wanted. Back geared with dividing head or centers, vise, all necessary parts that generally go with machine. Must be in working condition. Desire to buy from a manufacturer or owner, wishing a chance to dispose of one that they have no use for. No fancy prices entertained. Address Herman Fletcher, Louisville, Ky.

Talks With Our Readers

By The Sales Manager

AMERICAN MACHINIST:

I have made a success as a machine tool salesman in spite of the fact that I have not had any technical training, any shop experience or any special aptitude for this particular calling. Most all the credit for my success is due to the fact that the manufacturers of the tools I sell are large advertisers in your magazine.

Now do not think for a moment that I am merely an order taker or an office man that dictates a proposition to a customer, sends him a catalog, and writes him a few days afterward to ask if his bid has been received and what are the prospects for getting the order. No, I get right out in the shop and talk with the superintendent or production engineer, or any other party who wants to be shown.

I mentioned above that the concerns I represent advertise extensively in your columns, not only extensively but intensively as well. By this I mean that their advertisements as a rule are not general in their scope, but rather much to the point on one or two particulars. Such advertisements carry force and character with them and at the same time impress you with their directness. Tell a customer that your lathe has been designed throughout to stand the strains incident to the use of high-speed steels and he will reply wearily, "Oh, that's what they all say." But show him a longer bearing of the carriage on the shears, a wider bridge, larger bearings, steel gears where he has been used to finding cast ones and that man is interested.

Six years ago I was a clerk in a bank drawing $60 a month. The bank I was with was consolidated with another and I was out of a position. A friend of mine, a traveling man, told me of a position that had been offered to him selling machine tools for a local supply house. He, however, did not care to make a change at this time and advised me to apply for the situation. I demurred, saying that I knew absolutely nothing about the selling game. "Well, you can learn it, can't you?" he said, rather testily, I thought, and then he gave me a good bit of advice: "Never tell a man you can't do a thing until you try, and ninety-nine per cent. of the time you will be surprised at what you can do."

So acting upon his suggestion I called upon the manager, and the first question he asked me after I stated the nature of my visit was, "Can you sell machine tools?" I said I could. "Well, what experience have you had?" I told him I had not had any.

I felt that if I allowed him to question me too much that he would find out how little I really knew, so I followed up my last remark with the assertion that to prove how certain I was of making good that I was willing to take the place for six months at a reduction of twenty-five per cent. of the salary he regularly paid an experienced man. I guess my earnestness impressed him, for when I left it was with the understanding that I was to go to work the first of the month at a salary of $75 a month.

One of my old schoolmates had for several years been an instructor in manual training at one of our local high schools. I knew he had served his apprenticeship and worked as a machinist in one of the large railroad shops before taking his present place, and I felt that he was the man to help me. I called at the school and told him just what I was up against. He smiled when he said: "Old chap, it appears to me that you have severed a much larger morsel than you can thoroughly masticate at one time, but my first suggestion would be to secure the names of the different manufacturers your employer represents and get complete catalogs covering their lines. Read them over carefully, get the general outlines of each tool in your mind so that you can tell a lathe from a planer; then come down here mornings and I will tell you the uses for which each tool is intended. Spend the rest of your time at the Public Library where you will find the AMERICAN MACHINIST on file. Get the back numbers for the past five years and READ THE ADVERTISEMENTS. Pass up all the reading matter unless it refers directly to the machines you are going to sell."

I followed my friend's suggestions to the letter, spending my mornings at school and dividing the rest of my time between the catalogs at home and the files of the AMERICAN MACHINIST at the Public Library. Before long I noticed that the advertising columns proved more interesting and instructive than the catalogs, and ever since I have used the catalogs merely for reference and now look to the advertisements for genuine information.

On the first of the month I started to work. The first deal I lost on account of price. The second deal I lost because I couldn't tell my customer the difference between my tool and the tool my competitor was offering. I knew all about my tool but I didn't know anything about his, and I found out he knew about both. Right then it dawned on me that it was just as essential to find out what my competitor was offering as it was to know what I was offering, and the quickest way to get this information was to read his advertisements.

I bought all the back copies of the AMERICAN MACHINIST that I could and separated the reading matter from the advertising. Then I got busy with shears and paste-pot, and pretty soon I had all the lathe data in one pile, planer matter in another, and so on.

I purchased two hundred plain manila folders, size 10x7", a cheap filing case to hold them, one hundred plain cards, size 3x5", and an alphabetical index and holder. The folders I numbered consecutively from 1 up. To the right of each number I wrote the name of some firm whose ad I thought worth while saving. Each folder contained information relating to but one type of tool made by one concern, but as far as possible I tried to keep the same types together. For instance, I had advertisements covering a dozen different drill presses made by different people. Instead of putting all this information in one file and indexing it under "Drill Presses," I made a separate file for each one and numbered each one separately. Each firm had a different number, and notation to this effect was made on my index cards.

From the very beginning I had occasion to refer to this "ad-file" of mine, and before the file was anywhere near completed I sold a milling machine to a customer who told me after that his mind had been made up for some time to buy a competitor's machine. This machine had been on the market several years longer than the machine I was selling, but I was able to convince my friend that the tool I was offering not only embodied all the good points of the other but several additional ones. In fact, I took my files on milling machines over to the superintendent and showed him step by step what progress had been made in milling machine design si... my competitor brought out his machine. The argument was convincing and I got his order. In this particular case it happened that the machine I was trying to sell did not suffer in comparison with the other, but I have since learned it is not the best policy to offer too much information about the other fellow's machine. Sometimes a buyer sees an advantage in this information that a salesman who is not practical is apt to overlook.

With salary and commissions my income the past three years has averaged nearly $4000 a year. I now have charge of all our machine-tool salesmen, and have impressed upon them the absolute necessity of reading all advertisements relating to our business. My original filing case has been replaced with one of eight times its capacity, and there isn't a day but what these files are consulted by myself or my assistants. They have proved of inestimable value to us all.

While this article of mine has dwelt largely on the benefits I have derived from what I term educational advertising, yet I want to emphasize the fact that these benefits are open to all from apprentice to general manager in the shops and from city desk to president in the supply house.

I believe, too, that the broad publicity of details the uptodate manufacturers are giving their respective tools has done more to improve machine-tool standards than anything else, because if one manufacturer brings out an improvement and advertises it you may depend upon it that his competitor will not be far behind with a similar improvement, and thus the whole industry is benefited.

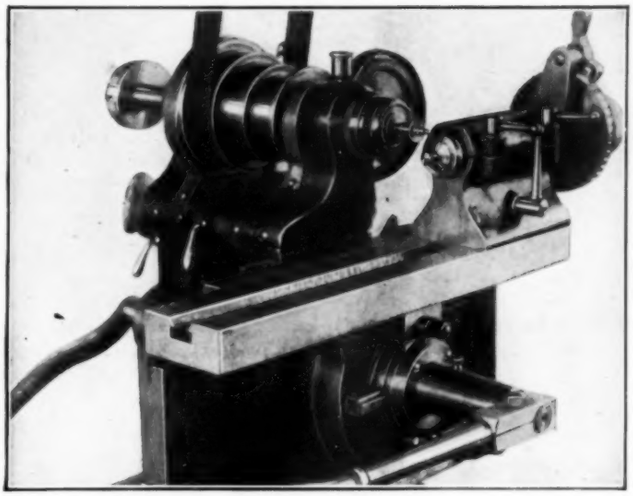
C. H. SEYMOUR.

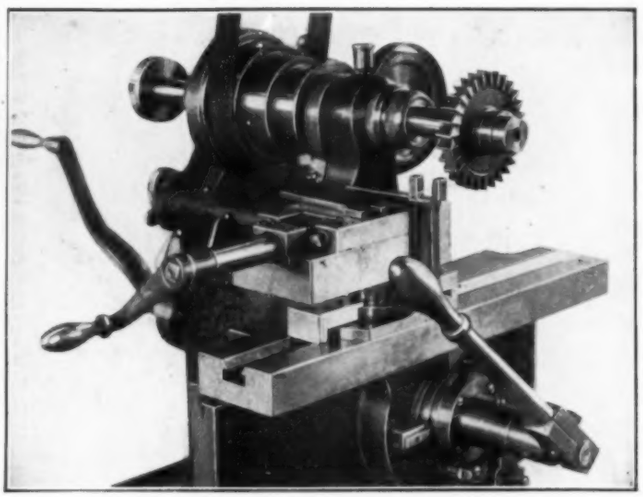
May 20, 1912.

* * *

Only reliable products can be continuously advertised.

Examples Of Rivett Precision Work





No. 6. Two Examples Of Work On Rivett Bench Millers

The RIVETT miller combines lightness and rigidity unusual in so small a tool.

The illustration on the left shows a 4-in. milling cutter used to finish the fork held in the vise.

The other illustration shows the same machine equipped with a dividing head having a draw-in chuck. It also has a small milling cutter, or saw, $1\frac{1}{2}$ in. in diameter and having 150 teeth. Its thickness is only 0.003 in. This cutter is, of course, very delicate and can be used successfully only in a rigid machine. It is run at 150 r.p.m.

Rivett Precision Tools

were the original "Precision" Machines and have always remained the best. We'll be glad to send you Catalog 27, describing them. Write for your copy.

The Rivett Lathe Manufacturing Company

Brighton, Boston, Mass.

Rivett Lathes are carried in stock by Hill, Clarke & Co., at New York, Philadelphia and Chicago; Pacific Tool & Supply Co., San Francisco, Cal., and Motch & Merryweather Machinery Co., at Cleveland. Messrs. Buck & Hickman, Ltd., 2 and 4 Whitechapel Road, London, E.; 55 Station St., Birmingham; 3 Cross Street, Manchester, and 27 Cadogan St., Glasgow, Scotland, for the United Kingdom.

IF you properly value accuracy in gear cutters and want to reduce their cost by lengthening their life, investigate the gear cutter grinding machine shown on page 87.

BROWN & SHARPE MFG. CO.,
Providence, R. I., U. S. A

LE BLOND

MILLERS
Eight Sizes of Plain,
Six Sizes of Universal.

Send for Catalog

The R. K. LeBlond
Machine Tool Co.,
Cincinnati, Ohio.

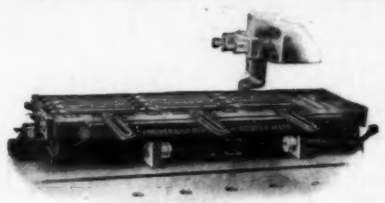
More than 25,000
TRADE MARK
BRISTOL'S
REG. U. S. PAT. OFFICE.
Recording Pressure Gauges
have been sold.

See partial list of users in Catalog No. 1000.

Bristol's Recording Gauges are regularly furnished for use with hundreds of different charts and will be submitted on 30 days trial.

Write for new 64-page Catalog No. 1000 listing the most complete line of Recording Gauges in the world.

THE BRISTOL CO.,
Waterbury, Conn.



Asbestos Covered Magnet Wire

costs us three times as much as ordinary magnet wire.
We use it on all our wet chucks and make no extra charge.
Our customers' interests are our own.

O. S. WALKER & CO., WORCESTER, MASS.

"CLEVELAND" Telltale Hole Drills

will enable you to comply with the new Federal Stay-bolt Inspection Law at the lowest possible expense, because they are especially designed for drilling tell-tale holes in stay-bolts.

There are mechanical reasons for this drill's dependability—the short flute, $1\frac{3}{4}$ inches, with plenty of clearance, combined with the specially tempered shank, give unusual toughness and strength.

The user of air and electric portable drills appreciates the toughness of "CLEVELAND" Telltale Drills. With them breakage, the greatest bug-bear in this kind of drilling, is reduced to a minimum. When you are up against it, give them a trial.

Circular No. 18-A gives the facts. Write for a copy at once.

The CLEVELAND Twist Drill Co.

New York CLEVELAND, O. Chicago